TENDER DOCUMENT

PROCUREMENT OF ELECTRICS FOR COKE PUSHER

PURCHASE DEPTT. / MM DIVISION
HEAVY MACHINE BUILDING PLANT
HEAVY ENGINEERING CORPORATION LIMITED
P.O.-DHURWA, RANCHI

HEAVY ENGINEERING CORPORATION LIMITED, DHURWA, RANCHI - 834004
PHONE: 0651 2401278, FAX: 0651 2401166, EMAIL: pksingh@hecltd.com

Tender Enq.No.HMBP/PUR/2011/961723/EL-**3405** **Dated: 14.08.2012**

Due Date of Tender opening: 30.08.2012

Enquiry Schedule

Scope of Work: This tender specification calls for turnkey execution of the job covering the design, engineering, manufacture, supply FOR HMBP stores at Ranchi, receipt of material from purchaser's store at DSP, transportation from purchaser's store at DSP to coke oven site, handling, storage and re-conservation at DSP site, erection, testing, commissioning of electrics with standard accessories and attachment as covered in this specification. Demonstration of the proper functioning of the electrical system during performance guarantee test of the equipment in a coordinated and integrated manner as per the relevant clauses of this specification.

QUALIFYING CRITERIA:

1) The tenderer should have carried out electrical work related to steel plant equipment including VFD & PLC in past, covering design, engineering, supply, erection, testing & commissioning. The claim should be substantiated with submission of documentary evidence including performance certificate from the users/customers.

2) The annual turnover of the tenderer shall be minimum 3 cores in last three consecutive financial years. Tenderer shall submit audited balance sheet for last three years.

Terms and Conditions:
1) The offer must be prepared taking reference to the detailed technical specifications & other details in the enclosed DAP-**203/12M**

2) Please submit your quotation strictly in three part system i.e.:-
a. Techno-commercial bid-Part I (This Techno Commercial bid shall be confirming all technical specification, commercial terms & conditions and price format with price column blanked (Unpriced). The price format should contain item wise list of items for which the price has been quoted.**)**

b. Price Bid -Part II (This part will comprise price format duly filled in**)** and
c. Earnest Money Deposition (EMD) -Part III (This part will contain only DD / Bank guarantee in favor of HEC Limited Ranchi-4, for Earnest Money deposit.)

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3) a. The technical and commercial aspects to be sealed in a separate envelope super scribing Part-I on it .The Price bid to be super scribed as Part – II and EMD to be super scribed as Part-III.
b. All the three bids i.e. Part-I, Part II & Part III shall be in separate sealed covers clearly super scribing on the top of each envelope the relevant part number, tender reference number with date and due date of opening.
c. All the three bids i.e. Part-I, Part II & Part III shall be enclosed in one envelope. This envelop shall also be super scribed on the top with relevant tender no. and due date of opening.
4) **The Payment Terms shall be as under:**
"90% of the total value of supply part along with hundred percent taxes & duties shall be released through Cheque/RTGS within 60 days of receipt of materials complete in all respect along with Guarantee Certificate, Test
Certificate, Inspection Certificate (to be issued by HEC), EDGP (if applicable), Original Invoice, 10% PBG (Performance Bank Guarantee) to be valid till full guarantee period from any nationalized bank only in HEC's format and all the drawings and documents as per enquiry specifications. "

"Balance 10% of the value of supply part along with the erection and commissioning charges shall be released through Cheque/RTGS within 30 days from the date of issue of Commissioning Certificate by HEC/Customer "

5) **Guarantee Clause:** The materials supplied shall be guaranteed for 12 months from the date of commissioning or 18 months from receipt of material whichever is earlier.

6) **Liquidated Damages (L.D):**For late delivery, the L.D. @0.5% per week limited to 10% maximum shall be levied on the order value.

7) Place and Time of submission of quotation:
Place: Purchase Deptt./HMBP/HEC Limited, Dhurwa, Ranchi – 834 004.
Date & Time of receipt of tender: 30.08.2012 Upto 1.00 P.M.
Date & Time of opening of tender: 30.08.2012 at 3.00 P.M.

8) EMD of 2% of the quoted price shall be submitted in separate sealed cover. The E.M.D. shall be submitted in the form of Demand draft / Bank Guarantee from any nationalized bank and in favor of Heavy Engineering Corporation Limited payable at Ranchi. **The firm shall mention about the submission of EMD in their techno-commercial bid indicating DD No./Bank Guarantee No., Date etc.** ***BUT THE AMOUNT OF D.D. /VALUE OF BANK GUARRANTEE SHALL NOT BE MENTIONED IN THE TECHNO-COMMERCIAL BID. IT MAY PLEASE BE NOTED THAT EMD SHALL BE REFUNDED TO THE UNSUCCESSFUL TENDERERS.***

9) **Security Deposit: The** successful tenderer will have to deposit Security deposit for 5% of the basic order value (in form of bank guarantee) within 30 days time after placement of order .The validity of security deposit shall be up to receipt of last consignment .

10) Performance Bank Guarantee (PBG): The successful tenderer will have to furnish PBG of 10% of the Basic order value of purchase order valid till full guarantee period from any nationalized Bank only in HEC's Format .

11) Schedule of Tender receipt by 30**.08.2012 up to 1.00** PM. Opening of Tender on **30.08.2012, at 3.00PM, TENDERS** must be submitted in sealed cover with Tender No. and the Due date super scribed on it failing which Tenders may be ignored.
12) The rate quoted shall be firm and the prices quoted must be on FOR: Destination i.e. Stores/HMBP/HEC Ltd RANCHI - 4 Basis including packing, forwarding, freight & insurance charges.

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13) The Price quoted by the tenderer should be exclusive of sales tax. The rate and nature of sales tax applicable should be shown separately. Sales tax will be paid to the seller at the rate at which it is liable to be assessed or has actually been assessed on the date of supply provided the transaction of sale is legally liable to sales tax and within the delivery period. Any change on the taxes & duty structure beyond the delivery period will not be considered by HEC.
14) The rates quoted must be firm and offer's validity for acceptance must be valid for minimum 04 months from the date of opening of tender.
15) Quotations erased or over written are likely to be rejected unless all corrections are authenticated with the tenderer's signature.
16) **Delivery date** offered must be specified and guaranteed. **Delivery within 2 to 3 Months is preferred.**

17) Full particulars i.e. specification, literature and / or drawing wherever applicable should be submitted along with the quotation. The brand and 'Make' name must be indicated.
18) The Corporation does not pledge itself to accept the lowest or any tender and reserves to itself the right of accepting the whole or any part of tender or portion of the quantity offered and you shall supply the same at the rate quoted.
19) Supplies will be subject to Inspection by our Inspection wing / or inspection agencies prescribed by us.
20) Order placed as a result of this tender will be subject to the Corporation's General Terms and Conditions of contract which can be down loaded from our website (www.hecltd.com)
21) Corporation reserves the right to call for and examine at any time the books of accounts and other documents and papers of the firm for the purpose of ascertaining whether any excess payments has been made or the firm likely to be received / received undue benefit out of execution of the particular contract.
22) Delivery: The time for and the date of delivery of the Stores stipulated in the acceptance of tender shall be deemed to be the essence of the contract and delivery must be completed not later than the dates specified therein. Otherwise:
a) The purchaser to recover from the contractor a sum of 0.5 % per week (completed week) of the price of The stores (up to maximum 10 %) as liquidated damages, which the contractor has failed to deliver as Aforesaid or
b) The purchaser may procure the undelivered stores / similar items from elsewhere, without notice to the Contractor at the risk of the contractor without canceling the contract in respect of the consignment not yet due for delivery or,
c) To cancel the contract or a portion thereof.
23. Income Tax Clearance Certificate - All tenderers shall submit along with their tender an Income Tax Clearance Certificate duly countersigned by the Income Tax Officer of the circle concerned under the seal of the office. Copy of Permanent Account No. (PAN) (Of Income Tax) to be enclosed with the bid.

24. There is no obligation on our part to accept delayed / late tenders. Tenders received after the due date of opening are liable to be summarily rejected.
26. The rates quoted shall also be inclusive of embossing on the material. The Ownership namely HMBP / FFP / HMTP should be at a predominant place of the material to a size / thickness upon the volume of the material.
25. Way Bills/ Road Permit: No consignment from outside the state of Jharkhand shall be dispatched by the Supplier without a valid way bill / Road Permit, to be issued by PURCHASER.
26. The Supplier shall produce documentary evidence as may be called for by PURCHASER in respect of taxes, duties etc. paid by the Supplier.
27. **Termination of Order:-**
i. The order can be terminated if the supplier fails to deliver the goods in time.
ii. Any other reason due to which company thinks it fit to terminate the order.
iii. In the event of the termination of the contract in part/ full the company can get the work Completed from any other agency/ departmentally at the risk and cost of the supplier.
28. **MODE OF DESPATCH**

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By road to the consignee: In-charge, Stores, HMBP, HEC Ltd, Ranchi. For the consignments to be dispatched by Road, the supplier shall ensure that the following are observed by them:
i) All dispatches must be affected only on receipt of written dispatch clearance from PURCHASER.
ii) You shall dispatch all the materials consigned to In-charge Stores, HMBP, HEC Ltd, Ranchi
iii) Care shall be taken to avoid damages during transit to ensure that all packages are firmly secured.

29. **PACKING, FORWARDING AND SHIPMENT**

a) The Supplier shall notify the Purchaser of the date of each shipment from his works, and the expected date of arrival at the site for the information.

30. **OTHER TERMS AND CONDITIONS**

Other terms and conditions which are not mentioned above shall be as per General Terms and Conditions of Contract of the Corporation which can be downloaded from our website (www.hecltd.com).

Important: While submitting tender please mentioned your Registration No. with HEC as a registered vendor with valid paper. If not please get registered your firm with HEC Limited immediately.

(P.K.Singh)
Sr.DGM/PUR/HMBP/HEC Ltd.

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2)The annual turnover of the tenderer shall be minimum 3 crores in last three consecutive financal years. Tenderer shall submit audited balance sheet for last three years.

1.0 INTRODUCTION

1.1 BACKGROUND

1.1.1 SAIL-DSP was set up as an integrated steel plant in India. The plant is located at Durgapur, in Burdwan district of West Bengal & is located on the main Howrah- Delhi railway line.

SAIL- DSP desires to rebuild Coke oven battery no. 2

1.2 COKE OVEN BATTERIES

Main parameters of the batteries are given below:

Parameters	Battery No. 2
No. of ovens	**78 (2 blocks of 39 ovens each)**
Oven Dimensions	
Height	**4450 mm**
Avg. width	**450 mm**
Length	**13590 mm**
Useful volume	**23.8 m^3**

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1.3 Oven Parameters

a)	**Number of Ovens**	**78**
b)	**Oven height**	**4450 mm**
c)	**Oven width**	**450 mm(average)**
d)	**Oven length**	**13590 mm**
e)	**Oven taper**	**60 mm**
f)	**Oven volume**	**23.8 m3**
g)	**Oven pitch**	**1100 mm**
h)	**Oven sole level**	**+84296 (Cold)/ +84326 (Hot)**
i)	**Pushing series**	**5-2**
j)	**No. of charging holes**	**4**
k)	**No. of gas collecting mains**	**2**
l)	**Quenching system**	**Wet quenching**
m)	**Coking Time**	**18 Hours**
n)	**Track level**	**+77590**

1.3.1 **Pertinent data in respect of the machine tracks (machine tracks are covered in Battery proper) are as follows:-**

Machine Tracks	Rail	Gauge (mm)	Wheel Load (max)	Maximum length (mm)	Power Feed
Pusher Car	**CR-100 (178.5 lb/yd)**	**10058 (C/C)**	**19t (max.)**	**15700**	**Trolley Wire**

1.4 Travel Mechanism

Travel mechanism shall be designed to prevent derailing of the machine. Provision for easy re-railing shall be provided.

Spring grid couplings shall be used between motor and reducer of LT mechanisms.

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Emergency stop provision shall be provided near LT drives for Pusher Car

Generally the LT speed shall be kept on lower side subject to fulfilment of average pushing rate of 96 ovens per day considering 22 hr/day pushing time and other technical/operational requirement.

Fail safe spring engaged DC electromagnetic brake shall be provided as parking brake.

1.5 Track details:

a)	Track rail size	CR 100 (178.5 lb/yd)
b)	Weight of rail per meter	88.96 kg
c)	Track center to center distance	10058 mm
d)	Gradient	Level
e)	Curvature	Nil

1.6 Main Features of Machine:

Type	Single spot with hydraulic drives
Arrangement of leveller with respect to pusher ram.	Right of pusher ram (looking at the battery from pusher side)
Control of drives	By PLC
Speed control of LT drives	By means of A.C. squirrel cage motors with VVVF control and frequency converters.
Speed control of ram drive	-do-
Speed control of leveller drive	-do-
Centralised Lubrication System	Motorised multi line/ two-line system
Power Collectors	As existing

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Spotting System	Refer electrics write – up (Annexure-II)
Emergency drive for Pusher Ram	Withdrawal by air motor & an electrical winch with manual operation facility
Pusher Ram	Straight with rack & pinion
Cleaning of rack teeth	By compressed air
Measurement of pushing Force	By Ammeter, to be displayed digitally in the Operator's Cabin
Degraphitising	By ram head mounted cutters and compressed air
Protection covers for Pusher Ram	To be provided.
Leveller emergency drive	Electric winch along with manual operation facility
Leveller spillage coal bunker	To be provided. Capacity to suit at least 14 (fourteen) oven cycles
Leveller door opener	Upward opening, mechanized by means of LDT mounted hydraulic cylinder
Leveller muff	With air curtain. Muff sleeve movement by hydraulic cylinder
Safety barriers	To prevent access through service bench during pushing.
Door Extractor	With Vertical compensation Door turn by Hydraulic Cylinder
Frame Cleaner	Spring mounted scrapers to clean sealing surfaces, internal side surfaces, oven sole & side surfaces, mounted on carriage with vibrator. Oven sole cleaning with compressed air. Vertical & Horizontal movements by means of Hydraulic cylinders
Door Cleaner	Spring mounted cleaning tools

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	mounted on travelling carriage with vibrator. Hydraulic cylinder operated
Operator's Cabin	Double – walled with insulation. Air conditioned. Roof & side sheeting – SS plates
Hydraulic cabin	Double – walled with insulation. Air conditioned. Roof & side sheeting – SS plates
Electronic panel Cabin:	Double – walled with insulation. Air conditioned. Roof & side sheeting– SS Plates
Electric Panel Cabin	Ventilated with pressurised filtered air
UPS	See Electrics (Annexure-II)
Interlocking with other Oven Machines	See Electrics (Annexure-II)
Hydraulic System :	
Fluid	Water Glycol
Main Pumps	Pressure compensated axial piston pumps (1 working, 1 standby)
Cooling filtration System	Separate with air – oil cooler and duplex filter
Tank	Stainless Steel oil tank, t = 6 mm
Piping	Stainless Steel pipelines & fittings
Emergency Drive	By accumulator and hand pump
Pneumatic System	- 2 Compressors on each pusher car. - Air Receiver of 10 m^3 capacity. - for Degraphitising of oven roof and stand pipe ports - Blowing soot from the ram rack surface - For emergency withdrawal mechanisms

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Air conditioners	Split type (LINTERN,USA make)
Laser gun	To be provided for spotting
Heavy duty Industrial Vacuum Cleaner	For Cleaning Cabins & equipments
Water jet with SS tank	To Quench spilt coke & door blazing
Pushing Load transfer	To civil foundation of Pusher car track

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1.7 Desired Speeds:

a)	Long Travel	60 m/min.
b)	Pusher	25 m/min.
c)	Leveller:	45 m/min.
d)	Door screw turning	Through cyclo gear box
e)	Other mechanisms:	Designed speed of drives shall be commensurate with the overall machine cycle time
f)	No. of pushes	96/day
g)	Cycle time	Less than 600 seconds
h)	Speed of hydraulically operated devices	6 m/min

1.8 Other Parameter:

1.8.1	Height of end buffers above rail level	755mm
1.8.2	Clearance with the battery	As per machinery diagram
1.8.3	Buffer to buffer distance	15700 mm
1.8.4	Distance from oven face (Hot) to first rail	3862 mm
1.8.5	Clearance	32004 mm between CL of battery and extreme point of machine outer edge along the length of oven.
1.8.6	Oven sole level (Hot)	+84323 mm
1.8.7	Pusher ram length	22320 mm
1.8.8	Pusher ram travel	19750 mm
1.8.9	Max. Pushing force	28t
1.8.10	Leveller Bar length	21600 mm

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	Leveller bar travel	14410 mm
1.8.11	Wheel loads	Not more than 19 tons (Max. permissible load due to limitations of the existing track)
1.8.12	Power Supply and Electrical Systems	
	Power Supply	415 Volt.,3 phase ,50 Hz
	Control Voltage	230 Volt, single phase ,AC, 50 Hz
	Lighting, air- conditioning and fans	230 Volt, single phase ,AC, 50 Hz
	Solenoid valves	24V D.C

1.9 Drives:

	Motion	Drive
-	Travel	Electric motor with gear box
-	Pushing	Electric motor with gear box
-	Leveller	Electric motor with gear box
-	Door screw turning	Through Cyclo gear box
-	Door swiveling	By Hydraulic cylinders
-	Door Extractor Travel	Hydraulic Cylinder
-	Door Lift	LDT mounted hydraulic cylinder
-	Door Latch bars	Hydraulic Cylinder
-	Vertical Compensation device for door extraction	LDT mounted hydraulic cylinder

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-	Frame Cleaner Travel	Hydraulic Cylinder
-	Frame Cleaner swiveling	By Hydraulic cylinders
-	Frame Cleaning	Hydraulic Cylinder
-	Frame cleaner spring pressing	Hydraulic Cylinder
-	Frame cleaner fixing	Hydraulic Cylinder
-	Frame cleaner blocking	Hydraulic Cylinder
-	Door Cleaner Carriage	Hydraulic Cylinder
-	Door top horizontal cleaning	Hydraulic Cylinder
-	Door bottom horizontal cleaning	Hydraulic Cylinder
-	Door vertical cleaning	Hydraulic Cylinder
-	Door Cleaning travel	Hydraulic Cylinder
-	Leveller Door opening	LDT mounted hydraulic cylinder
-	Leveller Hood muff	Hydraulic Cylinder
-	Leveller Sluice travel	Hydraulic Cylinder

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-	Spillage Coke deflector	Hydraulic Cylinder
-	Coal spillage chute	Hydraulic Cylinder
-	Spillage Coal Bin Discharge Gate	Hydraulic Cylinder

1.10 Functional Description

1.10.1 List of Functions:

These are the functions required for servicing the ovens:

- Machine travelling
- Door servicing including slewing
- Interlocking the machine during the pushing procedure
- Pushing of the coke
- Removal of roof carbon in the gas collecting space in the oven chamber.
- Removal of carbon from the standpipe port in the oven chamber.
- Opening and closing the leveller door.
- Sealing the leveller hole during levelling by leveller muff & air curtain.
- Levelling the coal charge.
- Cleaning the oven door.
- Cleaning the door frame.
- Collection and removal of leveller coal.
- Removal of door cleaning residue into a collecting device.
- Guiding of spilt coke to the spillage conveyor.
- Collection & disposal of debris collected during ram withdrawal & door cleaning
- Generation of compressed air.
- Generation of hydraulic pressure.
- Air-conditioning of operator's cabin, electronic panel cabin & hydraulic cabin.
- Emergency withdrawal of the pusher and leveller beams.
- Spotting with the aid of laser spotting.

1.10.2 Spotting

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The Coke Pusher machine shall be spotted into working position at an accuracy of ± 5 mm or even better.
For further details, refer Electrical write-up Annexure-II

1.10.3 Door Extracting:

The door servicing equipment is slewed into working position and moved in front of the oven. The hydraulically operated lifting device moves the extraction arms under the extraction beams of the door. The door latches are disengaged the unscrewing them with the help of Cyclo gear box.

Hydraulic cylinder of the Vertical Compensation Device is blocked in tilted position. This is to ensure that the deviation from the vertical, which is caused by the chamber frame, shall be maintained while latching the door back after its pushing operation is over so that damage to the chamber frame and door sealing is avoided.

The door is then lifted by 30 mm approx. with the help of LDT mounted hydraulic cylinder, run back, lifted into the final position (to obtain the same level for the cleaning equipment) and slewed into the door cleaning equipment.

Re-installation of the door after completion of the pushing procedure and cleaning of the chamber frame is carried out in reverse sequence.

1.10.4 Pushing and Carbon Removal:

Prior to the beginning of pushing procedure, the machine sub structure shall be securely held in position with the help of a wedge type mechanism which can be lowered & lifted in order to provide a firm rest on the vertical impact surface on the machine track foundation. The traveling drives are then interlocked.

Pusher and leveller shall be driven by electric motors which, in connection with mill duty electro- magnetic DC brakes and /or proximity switches, ensure precise attainment of final or intermediate positions.

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For the removal of carbon from the gas collecting space, a carbon scraper on the pusher head and additional nozzles made of stainless steel charged with compressed air shall be provided.

An additional stainless steel nozzle supplied with compressed air cleans the pusher side standpipe port in the Oven Chamber.

1.10.5 Levelling:

The equipment for leveling and for opening and closing the leveller doors are located 5 oven pitches away from the center line of the pusher beam.

The leveller doors shall be opened or closed from the driver's cabin. Thus, it is possible to open the leveller door of oven N-5, level oven and close the leveller door again of oven N-5 when the pusher machine is in the proper position for pushing oven N.

The spilled coal during leveling shall be collected in a bunker which shall be so designed that the coal from 14 (fourteen) oven cycles (working cycles) can be accommodated in it. Bunker inner surfaces shall be provided with stainless steel liners.

The leveller coal is emptied from the collecting bunker into the existing spillage coal bunker of skip hoist at the coal tower.

1.10.6 Door and frame Cleaning:

During the pushing procedure, the door cleaning machine is moved to the slewed coke oven door and cleaning is done by horizontal and vertical tools moving to and fro, on the surfaces which are important for satisfactory sealing of the coke oven doors. All cleaning procedures are affected by resiliently compressing scraping tools. These are fixed at such intervals that the cleaning strokes overlap each other.

After completing the pushing procedure, the door frame cleaning machine, by slewing and moving it in front of the chamber frame, cleans the front surface of the door frame using tools moving to and fro, which is important for satisfactory sealing of the coke oven doors. Internal side surface are cleaned by separate set of cleaning tools.

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Additionally, with a special provision, the oven sole in the area of the door plug and the lateral wall sections up to a height of 0.5 m approx. are likewise cleaned. This is carried out by resiliently compressing scraping tools, the distances of which ensure safe overlapping of the intended cleaning strokes. The cleaning of stubborn deposits is assisted by vibrator & oven sole is cleaned by compressed air supplied through nozzles suitably located on the door frame cleaner. Thereafter, the oven door is reinstalled again.

The spilled coke after each pushing and door frame cleaning procedure is quenched by high pressure water jet & guided on to the spillage conveyor located on the service platform.

The door cleaning spillage is caught by a chute and likewise transferred to the collecting bin.

1.10.7 Emergency Drive for Pusher/ Leveller

An emergency air motor drive connected through a reduction gear box and hand operated clutch arrangement to the main drive of the ram beam shall be provided for emergency withdrawal of the ram. Additionally, an electrical winch with manual operation facility shall be provided as a failsafe device.
The air motor shall be able to withdraw the Pusher Ram even at an operating pressure of 2.5 Bar.
For withdrawing the Leveller bar in case of emergency an electrical winch with manual operation facility shall be provided.

1.10.8 Water tank with compressed air lines and outlet water lines for coke quenching & putting off door blazing to be provided.

1.11 Control and Interlocks:

The machine shall be controlled by the Operator from a position at the main control desk. This shall be laid out in an ergonomical manner and each main function shall be controlled in "automatic mode" by one desk switch e.g. "Remove Door" or "Replace Door". The individual motions of each main function shall be controlled by individual switches when in "manual mode", this feature is being provided for maintenance purpose.

Interlocks

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Travel Drive Left or Right	Operation by Control handle with dead mean feature	Frame Cleaner, Retracted Door Extractor, Retracted Leveller Door Opener, Retracted Pusher Ram, Retracted Leveller Retracted
Door Extractor Remove Door Replace Door	Automatic from desk switch	Pusher Beam, Retracted Door frame Cleaner, Retracted Door Cleaner, Retracted Travel Stopped
Pusher Ram	Push Operation by control handle on desk	Door frame Cleaner, Retracted Arm, retracted Door Hooks, Engaged Door, Lifted Cross Battery, Signalled Interlock

NOTE : Beam shall return automatically from end of stroke

Door Cleaner	Automatic from switch on control desk	Door Extractor Retracted
"Clean"	Desk or bench control (by selection)	Door Extractor, Hooks Raised
Door frame Cleaner	Automatic from switch on control desk	Pusher Beam, Retracted Door Extractor, Retracted
"Clean"	Control desk	Door Hooks Raised Long Travel Stopped
Leveller Door Opener	Automatic from switch on control desk	Long Travel Stopped
Open/Close Levelling	Automatic from switch on control desk (number of strokes variable)	Long Travel Stopped
Coal Spillage	Hydraulic valve control by bench-man	Ramp on bench operates permissive valve to dump coal to elevator boot at

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		coal bin.

Additional interlocks, if required shall be incorporated during detail engineering.

1.12 Operator Cabin:

The Operator's cabin shall consist of a steel framed cabin with bay type front window in toughened glass set in rubber strip. The control console shall be situated at the front of the cabin where there shall be good visibility of all the motions of the machine. The cabins shall be double-walled with thermal insulation and shall be air-conditioned. Outer walls & roof of operator's cabin shall be of stainless steel. All fixtures, fasteners & fittings on the cabin shall be of Stainless steel. Ambient temperature of machine operation shall be 60°C. Inside cabin the temperature shall be maintained at 24± 2˚C.

The cabin shall have double door entrance, with heavy duty door fixtures. The cabin shall be provided with cabin fans at suitable locations.

1.13 Electronic & Electric Cabin:

Immediately behind the operator's cabin shall be a wall with access door leading on to the adjacent but separate cabin, to house the electronic control equipment. The electronic panels shall be housed in this cabin. This cabin shall be double-walled with thermal insulation and air-conditioned. Outer walls & roof of Electronic cabin shall be of stainless steel. All fixtures, fasteners & fittings on the cabin shall be of Stainless steel. Inside cabin the temperature shall be maintained at 24± 2˚C.

The electric cabin shall be pressurized and ventilated by filtered air from fan filter units to prevent ingress of dust/ outside air. The cabin shall be provided with double door entrance. Outer walls & roof of the electrical cabin shall be of stainless steel. All fixtures, fasteners & fittings on the cabin shall be of Stainless steel. Ambient temperature of machine operation shall be 60°C.

1.14 Hydraulic Cabin:

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A separate cabin shall be built on the lower platform level of the machine to house the hydraulic equipment. The cabin shall be double-walled with thermal insulation and shall have double door entrance. The cabin shall be air- conditioned. Outer walls & roof of hydraulic cabin shall be of stainless steel. All fixtures, fasteners & fittings on the cabin shall be of Stainless steel. Inside cabin the temperature shall be maintained at 24± 2˚C.Ambient temperature of machine operation shall be 60°C.

Layout of the hydraulic equipments within the hydraulic cabin shall ensure adequate space for maintenance. The tank, main pumps & valve stand shall have separate location within the Hydraulic cabin.

ELECTRICS

2.0 Scope of supply & work:

i)	Work order no.	0093-002-110
ii)	Item code	5531711158
iii)	Qty.	1 set. for each coke pusher
iv)	Total Qty.	2 sets.

2.1 (a) This tender specification calls for turnkey execution of the job covering the design, engineering, manufacture, supply FOR HMBP stores at Ranchi, receipt of material from purchaser's store at DSP, transportation from purchaser's store at DSP to coke oven site, handling, storage and re-conservation at DSP site, erection, testing, commissioning of electrics with standard accessories and attachment as covered in this specification. Demonstration of the proper functioning of the electrical system during performance guarantee test of the equipment in a coordinated and integrated manner as per the relevant clauses of this specification.

(b) The technical specification shall be read in conjunction with General

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Technical Specification (GTS).The provisions given in these documents shall be complimentary to one another. However, in case of any conflict between the provisions of these documents with respect to technical matter, the provisions in the technical specification shall prevail.

(c) The scope of supply and work covers turnkey execution of complete electrics for coke pusher machine. The BOQ indicated in this specification covers all major electrical components. Any component not covered in this BOQ, but considered essential for proper functioning of the electrical system within the parameter of this specification shall be deemed to be included in the scope of work of this tender.

2.2 Reference drawings & documents(Intrested tenderer may request for soft copy of the drawings/documents.

1) Single line diagram- 1522.96.001
2) PLC configuration diagram- SK-EDB-1091
3) Sketch for electrical panel room-SK-EDB-1055
4) GA Drg. of coke pusher-1522.61.000
5) GCC- Relevant clauses applicable to tenderer.

2.3 The scope of work of Tenderer shall include but not be limited to the following:

- Current collectors.
- Isolators and protective switch gear
- AC Motors, Inverter duty motors fed from VVVF Drives, D.C. Electromagnetic brakes.

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- Rotary type, lever type, non-contact type limit switches and safety switches.
- Various types of sensors.
- Resistances.
- Motor control panels.
- Control desks for housing HMI system and other equipment as per specifications and inductive master controller for VFD drives etc.
- Programmable logic controller complete with required inputs / outputs for Pusher car. Touch screen monitors (15" or higher) with inbuilt RAM, key board, printers and other required peripherals. Cold standby system with redundant CPU, Power supply and communication porcessor shall be provided in each machine PLC. CPU shall be of latest version type.
- Variable voltage & variable frequency AC drives, tacho-generators/pulse encoders.
- Uninterrupted power supply system.
- Lighting transformer, lighting distribution panels, lighting fixtures with lamps, socket outlets..
- Power, control, heat resistant, communication & special cables.
- Earthing equipment and materials including electronic earthing.
- Submission of Drawings and documents including GA, SLD, BOM, Control scheme, QAP and all layout drawings, technical catalogues/ Data sheets.
- Arranging construction power supply and temporary lighting during storage, erection, testing and commissioning.
- Adequate number of shock treatment charts, danger and caution notice boards, first aid boxes, keys with key boxes, rubber mats.

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- **Electrical room / operator room furniture.**

- **Erection/installation/fixing materials like GI pipes, supporting structures for mounting of equipment, cable trays and their supporting structures, cable and pipe clamps, ferrules, asbestos wire rope etc.**

- **Commissioning spares & Consumables as required till the plant is commissioned and handed over to Purchaser. Minimum commissioning spares shall be supplied along with main equipment.(as per schedule- 1)**

- **Two years spares for normal operation & maintenance of equipment.(as per schedule-8)**

- **Tools & tackles required for maintenance of equipment. (as per schedule- 2).**

- Radio positioning & interlocking system for Pusher Cars shall be provided under Coke Heating & Control System (CHCS) Package. Following shall be provided by Tenderer (Machine package supplier) to ensure proper implementation of Radio positioning & interlocking system and CHCS System and included in scope of supply of Tenderer.

  a. **Porfibus connectivity to CHCS system PLC (Siemens make CPU-315-2DP). One number panel enclosure (800mm width) for mounting CHCS PLC and other accessories shall be provided inside the electric cabin.**
  b. **Machine operated related data generation essentially required for interlocking**
  c. **Joint implementation of communication software between m/c PLC and RTUs under CHCS system Package.**
  d. **UPS Power supply (1000VA) for CHCS PLC and other accessories.**
  e. **Aux. power supply as required.**
  f. **VVVF Drive for Machine travel mechanism shall be provided with Torque & Vector control so that Machine should operate at 3% creep speed.**
  g. **HMI Screen implementation (5 pages min.)**
  h. **Number of Tags as required.(200 minimum).**

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i. Tenderer shall work in close coordination with other automation suppliers and CHCS Package supplier for establishment of proper communication between oven machines, integrated operation of Oven machine radio positioning & interlocking up to 6 months from the date of commissioning for maximum three visits of one week each.
j. Space for cabling, cable trays, GI pipes etc by CHCS supplier.

- Data as required for CHCS system shall be provided by Tenderer and the same shall be finalized during detail engineering as per system requirement.
- Tenderer scope of supply includes all the components, materials and accessories required to render the equipment and system offered complete and fully operative in all respects even though every individual item necessary might not have been detailed out explicitly in this specification.

- Items not specifically mentioned but required for successful completion of the work are included in the scope of work of the Tenderer.

- The drawings shall be furnished by the tenderer during detail engineering as listed in clause-27 of this specification. Approval of these drawings from DSP/ MECON shall be responsibility of the tenderer

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2.4 The scope of supply for each coke pusher shall cover, but not be limited to the following items :-

BILL OF QUANTITY (BOQ), for each coke pusher		
Sl. No.	Description	Qty.
1	Spring loaded current collector, 500A	8 Nos.
2	Gravity type current collector, 500A (for earthing through rail)	2 Nos.
3	Isolator Panel, 630A	1 No.
4	PDB (for details refer SLD)	1 Set
5	MCC (for details refer SLD)	1 Set
6	Control supply transformer, 10 KVA	2 Nos.
7	UPS system, 5 KVA, 30 min. Back-up time. The UPS shall confirm to the specification as indicated in schedule-7.	1 Set
8	VFD for Travel motors(Heavy duty continuous current rating at 50 ^{0}C should be minimum-202A). The VFD shall confirm to the specification as indicated in	2 Sets.
9	DC Power pack, input 240V AC, output 24VDC,rated-50A	1 Sets
10	DBR for Travel VFD (Continuous rating minimum 12 Kw)	2 Sets.
11	DC Brake and BRP for Travel motors (4 X Ø300 mm Brake + 4 nos. BRP, for each brake separate rectifier panel shall be provided)	1 Set
12	Incremental Pulse encoder for Travel motors	2 Nos.
13	30 KW Travel motors, Frame – 225 M, 6 Pole. The Motor shall confirm to the specification as indicated in schedule-6	4 Nos.
14	VFD for Pusher RAM motors(Heavy duty continuous current rating at 50^{0}C should be minimum- 358 A) The VFD shall confirm to the specification as indicated in schedule-5	1 No.
15	DBR for Pusher RAM VFD(Continuous rating minimum 22 Kw)	1 No.

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16	DC Brake and BRP for Pusher motor (1 X Ø500 mm + 1 no. BRP)	1 Set
17	Incremental Pulse encoder for Pusher RAM motor	1 No.
18	110 KW Pusher RAM motor, Frame – 315 L, 8 Pole The Motor shall confirm to the specification as indicated in schedule-6	1 No.
19	VFD for Leveller RAM motor (Heavy duty continuous current rating at 50^0C should be minimum-103A) The VFD shall confirm to the specification as indicated in schedule-5	1 No.
20	DBR for Leveller RAM Drive(Continuous rating minimum 6 Kw)	1 No.
21	DC Brake & BRP for Leveller RAM motor (1 X Ø300 mm + 1 no. BRP)	1 No.
22	Incremental Pulse encoder for Leveller RAM motor	1 No.
23	30 KW Leveller RAM motor, Frame – 250 M, 8 Pole The Motor shall confirm to the specification as indicated in schedule-6	1 No.
24	2.2 KW screw turning motor, Frame – 112 M, 6 Pole	2 Nos.
25	Resistance boxes for Door screw motor (8 Ω / ph, 29A continuous)	2 Sets
26	Lighting supply transformer, 10 KVA	1 No.
27	Red warning lamp, ambulance type	2 Nos.
28	Laser Gun for spotting the machine	1 No.
29	Machine illumination fittings with lamp	1 Set
30	Absolute encoder for Pusher RAM Drive	1 No.
31	Absolute encoder for Leveller RAM Drive	1 No.
32	Control Desk (all the three master controllers in the control desk shall be suitable for 4-20mA analog signal, equivalent to GUSSMAN make, type no. – V81LB1T)	1 No.
33	Local control Panels (13 nos. approx.)in SS enclosure	1 Set
34	Junction boxes in SS enclosure	1 Set

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35	Limit switches a)Roller lever,heavy duty type limit switches(4 nos) b)Inductive type proximity limit switches with temperature protection housing.(28 nos), (equivalent to TURCK make, type no. – Ni-35-CP40-AN6X2 with protective housing-SG40/2) c) Magnetic type proximity limit switches with temperature protection housing (8 nos). (equivalent to TIEFENBACH make, type no. – WK209/2)	1 Set
36	PLC system, cold standby system with redundant CPU, power supply and communication processor. The PLC shall confirm to the specification as indicated in schedule-4 Ambient temperature - 60°C. Supply voltage – 24VDC. RAM memory- 1MByte (minimum) with battery backup. Non volatile memory backup. I/O handling capabilities – Discrete I/O - 10000 (minimum) Analog I/O - 4000 (minimum) For other details refer PLC configuration diagram	1 Set
37	Foot switch for electric bell	1 No.
38	Light fitting(Refer SLD)	1 Set
39	HMI, 15" touch screen, minimum 3000 tags, 200 screen	1 No.
40	Printer – A4 size Laser printer.	1 No.
41	List of Softwares 1. PLC programming software. 2. HMI configuration software. 3. Drive parameterisation software.	1 Set
42	Power cable, control cable (flexible copper cables) and all special cables for PLC, pulse encoder etc.	1 Lot
43	Cable accessories	1 Lot
44	Erection accessories inclosing mounting channels, fasteners etc.	1 Lot

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45	Asbestos rope for braiding on the cables exposed to heat/radiation.	1 Lot
46	Commissioning spare (as per schedule – 1)	1 Lot
47	Tools, tackles and instruments (as per schedule – 2) The minimum configuration of the Laptop shall be as given below- Core i7-2620M(2.5 GHz/1333/3 MB/35W) or higher, 8 GB RAM, 500GB HDD or higher, DVD-RW, 14.0" LED Back-Lit AntiGlare HD Display, HD Webcam, Dedicated Graphics with 1 GB GDDR5 Memory, Wireless LAN, Bluetooth, , USB 3.0, 6-in-1 Media Reader, 6 Cell Battery, MS Windows 7 Pro 64 Bit .	1 SET
48	Documents – The laptop shall have following software loaded. 1. Application software (PLC & HMI) 2. Drive parameter list. 3. Operation manual (Drive + PLC +HMI) 4. PLC programming manual 5. HMI programming manual	1 SET CD
49	2 years operational spare (only list to be furnished)	1 Lot

List of Proximity Switches & Limit Switches mounted on various mechanism:.

1. Proximity Switches (magnetic type)

Long Travel Mechanism - 2 nos.

Pushing Mechanism - 2 nos.

Levelling Mechanism - 2 nos.

Spare switches - 2 nos.

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2. Proximity switches (non-magnetic type)

Pushing Mechanism

Emergency Drive - 2 nos.

Levelling Mechanism

Emergency Drive - 1 no.

Leveller Door Latch engaging - 2 nos.

Smoke Sleeve Travel - 2 nos.

Transfer Chute Travel - 2 nos.

Spillage Coal Bunker Gate - 2 nos.

Door Extractor

Door Lifting & Lowering - 1 no.

Door Latching & Unlatching - 2 nos.

Door Cleaner

Travel - 2 nos.

Head Lifting & Lowering - 2 nos.

Frame Cleaner Head Lifting & Lowering - 2 nos.

Safety Barriers - 4 nos.

Spare switches - 2 nos.

3. Roller Lever Operated Limit Switches

Pushing Emergency Winch Drive - 1 no.

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Levelling Emergency Winch Drive - 1 no.

Spare switches - 2 nos.

2.5 Scope of service: -

2.5.1 Erection,Testing,Commissioning & Performance Guarantee test :

2.5.1.1 Erection is included in the scope of work of the tenderer.

2.5.1.2 For supervision of electrical erection work, the tenderer shall employ authorised persons holding valid electrical licence for the state of West Bengal.

2.5.1.3 For erection, SAIL-DSP shall provide only electric power at nearest available point. All other arrangement shall be made by the tenderer of their own at their own cost.

2.5.1.4 The consumables and spares required till successful commissioning of the coke pusher shall be arranged by the tenderer.

2.5.1.5 All tools & tackles including special tools shall be arranged by the tenderer.

2.5.1.6 The tenderer shall depute specialists in various disciplines from his organisation for erection, testing & commissioning. Exact period/ duration for deputation shall be mutually discussed and finalised.

2.5.1.7 The tenderer shall commission the complete electrical system of the machine.

2.5.1.8 The tenderer shall ensure that a minimum manpower is always stationed at site and additional manpower, if required shall be deployed depending on exigency of work till commissioning.

2.5.1.9 The coke pusher car shall be considered as commissioned on completion of first pushing of all the ovens provided it is completed within 30 days from the date of pushing of the first oven. However in case pushing of all the ovens is not completed within 30 days of the first pushing, commissioning would be deemed to be completed. The

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tenderer shall be responsible for proper functioning of the electrical system during this PG test.

2.5.1.10 The electrical system of the machine shall be guaranteed for capacity, performance and reliability for a period of twelve (12) months from the date of reaching the rated pushing level within the period of three months from the commissioning of the Battery. All equipment & component parts shall be guaranteed by the Tenderer against defective or improper materials, poor workmanship and failure from normal usage for one year from date of commissioning. If any defect or mal-performance occurs during the guarantee period, the tenderer shall make all the necessary/desirable alterations, repairs and replacements as desired by the Purchaser/ Purchaser's representative without any cost to the Purchaser.

2.5.1.11 The performance of individual machine shall be demonstrated for the following parameters:

- **Continuous and trouble free operation of the machine for 15 days maximum or as decided by the Purchaser at rated capacity of 96 pushings per day. During the above period, all mechanisms shall be made functional and shall operate in the proper sequence as envisaged in the design. For non-fulfillment of above performance attributable to the electrical system of the machine, 0.1 % of the total value of electrical system package shall be deducted for shortfall of every one oven of production.**

2.5.1.12 Separate experts for electrical system shall be deputed during PG test.

2.5.2 Responsibility matrix for free issue items :-

Sl. No.	Equipment	Equipment supply	Cable Supply	Installation	Commissioning
1.	Air Conditioning Equipment				
	a. A/c Unit	**HEC**	**Tenderer**	**HEC**	**HEC**
	b. Control Panel	**HEC**	**Tenderer**	**Tenderer**	**Assistance By Tenderer**

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2	Lubrication equipment				
	Control panel	HEC	Tenderer	Tenderer	Assistance By Tenderer
3	Pushing ram winch				
	Control panel	HEC	Tenderer	Tenderer	Assistance By Tenderer
4	Leveling ram winch				
	Control panel	HEC	Tenderer	Tenderer	Assistance By Tenderer
5	Hydraulic system				
	a. Hydraulic Unit	HEC	Tenderer	HEC	HEC
	b. Control panel	Tenderer	Tenderer	Tenderer	Tenderer
6	Pneumetic system				
	a. pneumetic Unit	HEC	Tenderer	HEC	HEC
	b. Control Panel	Tenderer	Tenderer	Tenderer	Tenderer
7	Vibrator	HEC	Tenderer	HEC	HEC
8	Air blower for leveller	HEC	Tenderer	HEC	HEC
9	Water pump	HEC	Tenderer	HEC	HEC

2.6 Following documents to be furnished by the tenderer along with the offer:-

1. Clausewise confirmation of TS.
2. List of deviation (if any).
3. Details of offered motor, VFD, PLC system etc.
4. Offered PLC configuration diagram.
5. Details of HMI, absolute encoder, proximity switches.
6. List of offered softwares for PLC, HMI & VFD.

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3.0 Climatic Conditions

3.1 The equipment offered shall be suitable for tropical and humid climate. However maximum temperature and 100% humidity may not occur simultaneously. The equipment shall also be suitable for elevations up to 1000 meters above mean sea level.

3.2 For the purpose of equipment selection and specially for de-rating the capacities of drive motors, switch gear and power cable an ambient temperature condition shall be taken as 60°C. However, AC drive (VFD) shall be selected considering 50°C and PLC shall be selected considering 55°C ambient temperature.

3.3 The equipment and cable on the machine shall be suitably protected against damage from radiant heat and shooting flames. All electrical equipments shall be of weather- proof and also dust and vermin proof. Unless specified otherwise, the enclosure class of the equipment shall be IP-55. Enclosure class for PLC & VFD shall be IP-42.

4.0 Standards

4.1 The equipment shall be selected, assembled and tested as per guide lines provided in the latest edition of "Indian Standard Specification" No. IS: 4137-1985 for class 3 & 4 duty cranes and shall be subject to any modification and requirement specified by the Purchaser. Electrical equipment shall also conform to following Inter Plant Steel Standards (IPSS) :

- **1-03-003-94 : AC mill/crane duty slip ring induction motors(second revision).**
- **1-03-004-95 : AC crane duty squirrel cage induction motors (second revision).**
- **1-03-011-92 : AC cabin fans for EOT cranes (first revision).**
- **1-10-002-82 : Resistance boxes for power circuits (with amendment 1).**
- **1-10-005-81 : Master controller.**

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- **1-10-006-81 : Drum/cam controller (with amendment 1).**
- **1-10-010-84 : General requirements for control panels for cranes (with amendment 1).**
- **1-10-011-84 : Particular requirements for control panels for AC cranes (with amendment1).**

4.2 The equipment shall also conform to the latest "Indian Electricity Rules and Regulations" in regard to safety requirements, earthing and other essential provisions specified there in. The equipment shall be designed and selected to facilitate inspection, cleaning, replacement and repair and for use where continuity of operation and safety are the main considerations. The Tenderer shall ensure that the equipments selected and provided by him shall have sufficient internal space for accommodating robust construction and adequate rating margins which experience has shown to be necessary in steel works operation and shall be ensured throughout manufacture.

4.3 All imported equipment shall be as per IPSS/IS/IEC without diluting Purchaser's TS. In case of conflict between Purchaser's TS & IPSS/IS/IEC, Purchaser's decision shall be final.

5.0 Power Supply Conditions

5.1 The power from trolley lines shall be available at 415 volts, 3 phase, 4 wire, 50Hz. The equipment selected shall be suitable for operation with voltage variation of +10% and -15%. The frequency variation shall be +4%, -6%. The combined voltage and frequency variation shall be +/- 10%.

5.2 The following voltage shall be used in the oven machine:

- **415 volts, 3 phase, 50Hz AC for motors.**
- **240 volts AC +/-10%. for control circuit.**
- **240 volts, single phase 50 Hz AC for lighting, air conditioning, ventilation fans.**
- **240 V AC for socket outlets for hand tools.**

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- **220 V, D.C. for electromagnetic brakes.**
- **24 V, D.C. for solenoid valves and I/Os of PLC..**
- **240 V, AC through UPS for PLC input supply.**

5.3 The different voltages mentioned above other than 415 volts, 3 phase, 50Hz AC shall be derived through individual separate transformer and transformer rectifier units- connected to 415 volts AC. The transformer shall have + 5% & + 10% taps on the primary side. One working and one standby transformer shall be provided for 240 volts AC control circuits.

5.4 The short circuit level of the system shall be considered as 50 kA for 1 sec.

5.5 The maximum voltage drop during starting of motor shall be limited to 15 % at the motor terminals without effecting the performance of motors. The following shall also be noted:

- **The voltage available at the motor terminals during starting shall be sufficient to ensure positive starting and acceleration of the motor under fully loaded condition without any damage to the motor.**
- **The voltage drop indicated shall be calculated with starting current corresponding to the rated voltage of the motor.**
- **For DC supply and UPS outgoing feeders, it shall be ensured that the voltage available at the equipment being fed by DC/UPS feeders shall be as per equipment design basis.**

6.0 Technical Specification

6.1 Current Collector & Trolley Lines

6.1.1 The trolley lines (4-0 Grooved Copper Conductor) 3 Ph, 4 wire for operation of Pusher car shall be supplied and erected by the purchaser. The location of trolley lines shall be indicated by the purchaser in clearance diagram of the machine so that the Tenderer can arrange for

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the main current collectors suiting these dimensions. Fourth trolley shall be provided for electronic earthing purpose. The electrical earthing of the complete machine shall be through rail.

6.2 Collector Shoes

The collectors shall be provided with spring loaded adjustable base along with head assembly with swiveling action current collector for all the three phases and earth in line with existing batteries. The collectors shall have adequate current carrying capacity. The design of collector shoes shall be such as to minimise the chance of bending at the hinge points due to dust or corrosion. Minimum 2 nos. current collectors per phase and earth shall be provided. Current collector for Pusher car shall be suitable for trolley line.

6.3 Collector Shunts

Current carrying shunts on all the collectors shall be designed so that there is no danger of contact with adjacent collectors. The shunts shall be easily replaceable.

6.4 Mountings

All the collectors shall be mounted on rigid steel supports and suitably insulated. Electrical clearance between live parts of adjacent shoes shall be at least 25 mm. Flexible shunts in their least favorable position shall not reduce this clearance. Collectors shall be designed for ease of maintenance and mounted suitably so that they are readily accessible for this purpose. Accordingly suitable working platform shall be provided. Further current collector to be suitably located so that spillage of coal & oil from the car does not fall on collector.

7.0 Specification of Motors

7.1 Except for Air Conditioning, Compressor and hydraulic drives, all motors shall be crane duty suitable for minimum 150 starts per hour, having duty cycle rating S-4, 40% C.D.F., unless specified otherwise. Motors for air Conditioning, Ventilation, Compressor and hydraulic drives shall be S1 Duty. Motor fed from VVVF drive shall be Inverter duty as per specification.

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All motors shall be totally enclosed, fan cooled, horizontal foot mounted with IP-55 protection class. The motors shall comply to the latest Indian, International standards and IPSS. The supplier shall be responsible for selecting the ratings that shall be required for the specified duty with type of control specified. Ambient temperature correction factors depending upon ambient temperature specified shall be used to de-rate the motor. The Tenderer shall clearly indicate the above de-rating factors in their design. The motor bearing shall be heavy / medium duty series.

The motor shall have cylindrical shaft extension.

7.2 All motors shall be squirrel cage motors. Inverter duty Squirrel cage motors with AC drive shall be provided for drives requiring speed control.

7.3 The motors shall be so selected that the motor temperature rise in actual service, which may include severe repetitive duty, interval of slow speed of operation, electrical braking requirements, etc., shall not exceed the permissible limits.

7.4 Horse power

The motor horse power shall be computed as per IS: 4137-1985. The frame size shall be selected according to `kW' mentioned against it in the relevant IPSS specification shall not be less than the designed/computed power. The calculations for selection of motors shall be submitted to consultant for approval.

7.5 Torque

The pull out torque of the motors at rated voltage and frequency shall not be less than 2.75 times of nominal torque.

7.6 Class of Insulation

The motors shall have minimum class 'F' insulation with temperature rise limited to class 'B'. Inverter duty motors shall have class H insulation with temperature rise limited to class F.

7.7 Thermistor Protection

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The intermittent duty motors shall be provided with thermistors to take care of thermal over stressing.

7.8 Travel motors on all the oven machines shall be preferably with synchronous speed of 1000 rpm.

8.0 Power distribution on machines

8.1 An on-load manual MCCB isolator with locking facility shall be provided immediately after current collectors on incoming line on the machines. Power from the isolator shall be taken to the moulded case circuit breaker followed by a power contactor. This circuit breaker shall be of crane duty type. The breaker shall be provided with under voltage, overload and short circuit releases. Fault level for the protective switch gear shall be 50KA (minimum). Power to utilities like illumination, fans, air conditioning etc. shall be taken after isolator.

8.2 Each motor feeder shall be provided with MCCB, contactor, EMPR and auxiliary contactors as required. Each solenoid feeder shall be provided with DPMCB and contactor suitable for DC rating. All power contactors shall be suitable for AC4 duty. Rating of power contactors shall be 50% higher than motor power requirement. MCB shall have minimum 9kA short circuit capacity.

9.0 Specification of Main control desk

9.1 Control desk shall be completely factory wired, sheet steel (CRCA, 2 mm thick) enclosed, free standing, floor mounted, with suitable covers and doors. Enclosure class shall be IP 54. It shall be suitable for corrosive atmosphere. The top cover where equipment shall be mounted shall be of stainless steel of thickness 2mm. All the equipment shall be mounted on the top cover with suitable inscriptions.

8.2 Control desk in operator's cabin shall contain:

- **Machine power 'ON' push button and indication lights.**
- **Selector switches for various sequences.**

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- **Push buttons and indicator lights required for auxiliaries control.**
- **Master controllers (inductive type / step by step type) shall be provided for the following:**
  - **Machine travel.**
  - **Pusher beam, leveller bar for pusher machine.**
- **Ammeters shall be provided for the following :**
  - **Pusher Ram Drive**
  - **Leveller Drive**
- **Touch screen Monitor of HMI system and printer.**
- **Operator station / control desk make shall be as per preferred make list.**
- **Particular requirement :-**
  - **All the three master controller shall be mounted on separate vertical stand.**
  - **Master controller for Long Travel mechanism shall be on LHS of operator"s chair.**
  - **Master controllers for Pushing Ram & Levelling Ram shall be on RHS of operator"s chair.**
  - **Components for frame cleaning mechanism shall be on RHS facia of control desk.**
  - **Components for door cleaning mechanism shall be on LHS facia of control desk.**
  - **Components for door extracting mechanism shall be on front facia of control desk.**

10.0 Specification of Control panels

10.1 All MCCBs, power and auxiliary contactors, EMPR, time relays etc. shall be mounted in sheet steel cubicles with lockable hinged doors. The door hinges shall be such that during repair work inside the panel, the door can be lifted and placed away enabling better access inside the panel. All ventilating openings shall have screen protection; interior of the panel

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should be dust and vermin proof. Control panels shall be fully weather proof. Enclosure class shall be IP-54. Thermal overload relays shall not be used.

10.2 Panels shall be front wired with readily accessible terminal blocks for making connection to the external equipment. Panels shall be pre-wired up to the terminal strip.

10.3 All the contactors, etc. shall be mounted in vertical arrangement with due consideration to the vibration encountered in the operation of machine.

10.4 The bottom most row of equipment mounted inside the panel excepting terminal strip shall be at least 350 mm above the panel bottom cover to facilitate inspection and repair. Panel shall be mounted such a way that bottom of panel is at least 150mm above the floor. The upper most row of equipment shall be at a height of 1550 mm (maximum) from the floor.

10.5 The terminal strip shall be fixed on the panel boards preferably in a horizontal manner, leaving enough space for termination of cables. Power and control terminals shall be separated from each other by means of replaceable insulated spacers. Terminal blocks shall have enough clearance to avoid tracking. The minimum size of terminal block shall be suitable for 10 mm^2 conductor. The minimum size of control terminal block shall be suitable for 4 mm^2 conductor.

10.6 All equipment on the panel board shall have permanent identification label in accordance with the circuit diagram and also the power and control terminals.

10.7 Terminal blocks shall be robust and of such construction so as to preclude the possibility of cable connections getting loose due to vibration on the machine. Sheet steel used for fabrication of panel shall be CRCA having minimum thickness of 2.0 mm. Panel shall be mounted such that bottom of panel is at least 150 mm above the floor.

10.8 Panels shall be suitable for operation in corrosive atmosphere.

10.9 Each panel shall accommodate equipment for one motion only. However, equipment for auxiliary drives may be clubbed in one or

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more panels. Power and control terminals shall be segregated. 20% spare control terminals shall be provided in each panel.

10.10 Fault indications shall be available on the doors.

10.11 Panels shall be mounted on suitable shock absorber pads.

10.12 Contactors

10.12.1 The rating of all the contactors shall be at least 50% higher than the respective motor full load current at the specified duty cycle, it is supposed to control. The power contactors shall be of AC4 duty and the minimum rating shall be 30 A.

10.13 Circuit protection switch gear

10.13.1 Protection switch gear shall consist of the following:

- **One triple pole MCCB fitted with over load release for protection against sustained overload and magnetic type instantaneous release for protection under short circuit conditions on all the three phases. The breaker shall have adequate rupturing capacity to withstand and clear fault current of the order of 50 kA.**
- **One triple pole contactor shall be provided after MCCB.**
- **A suitable arrangement shall be made in the system to facilitate control testing with power circuit off. This shall be done by providing disconnecting links in the power circuit. Arrangement shall be made for quick removal of links. These links shall be covered with a hinge type cover.**

- **To indicate when power and control sources are ON, pilot indication lamps shall be provided insider the driver's cabin.**

10.13.2 In addition to incoming circuit breaker, the following protective equipment shall be provided inside the driver's cabin:

- **Double pole MCBs for isolation and protection of lighting and socket outlet circuits.**

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- **One double pole MCB for isolation and protection of control circuit.**

10.13.3 For the protection of each drive motor and the control circuit for every motion of the car, Microprocessor based overload relays and miniature circuit breakers respectively shall be provided. The overload relays shall have adjustable settings. The over load relays shall have inverse time current characteristics and shall be self resetting type. NC contacts of all the overload relays shall be connected in series and incorporated in trip circuit of incoming breakers trip off. For protection of control circuit against sustained overload and short circuit conditions, miniature circuit breakers shall be provided for control circuit and shall be housed in respective control panel. Breakers shall be of reputed make.

10.14 Auxiliary switch-gear

10.14.1 All fuses shall be HRC link type.

10.14.2 Emergency stop push buttons (stayput type).

Safety switches of sustained contact type shall be provided at the entrance to the car so that under any emergency conditions, by operating the switch, the incoming circuit breaker is tripped thus cutting off power to all the motors. A pilot lamp incorporated in control circuit shall glow-up when any of these switches are operated. Further a mush room head type, "OFF" push button should be provided in the operator's cabin so that the main incoming breaker can be tripped under any emergency conditions by pressing the operating head. Safety switches shall also be provided near LT Motors for Charging car and Pusher car.

10.15 All outgoing feeders of MCC shall be as follows:

- **Motor feeders shall be provided with MCCB (suitable for motor protection) contactor & microprocessor based overload relay and required number of selector switches, control switches, auxiliary contactors, ammeters etc.**

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- **Power supply feeders shall be provided with MCCB, ammeter & voltmeter with selector switches.**
- **Control supply shall be protected with the help of miniature circuit breakers.**
- **Solenoid valves & DC magnets shall be provided with MCCBs/MCBs & contactors.**

11.0 Control modes

All the drives shall be controlled from HMI at control desk located in the operator's cabin. Following types of sequence control shall be provided.

11.1 Semi-automatic operation

- **Different process sequence shall be automatic. Progress of a sequence shall depend on limit switches or sensors corresponding to different positions.**
- **A sequence shall mean all the operations being performed on a mechanism at one and the same time.**
- **Each sequence shall be controlled from control desk by push button/key board.**
- **A sequence shall start only when all the preconditions and permanent requirements including healthiness of drives and circuit are met.**
- **It shall be possible to switchover to interlocked step-by-step mode during the operation of the sequence.**

11.2 Interlocked step-by-step operation

- **Each sub-sequence of the main sequence shall be controlled from control desk by separate push button/key board.**
- **The progress of sub-sequence shall depend on the limit switch position or sensors.**

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- **Each movement shall be started only after ensuring the necessary interlocks.**
- **The progress of each sub-sequence shall be displayed on the control desk and monitor of HMI.**
- **It shall be possible to switchover to semi-automatic mode only after the completion of a sequence.**
- **Provision of by passing interlock shall be provided incase of emergency. This shall be achieved by changing mode selector switch.**

11.3 Other features

11.3.1 All control shall be through PLC operated by master controller / push buttons / key board of HMI. Further local control stations shall be provided at suitable locations of drives for local control from PLC. All indicating lamps shall be of LED type only.

11.4 Annunciation and indications

11.4.1 An alarm shall be available in case of any fault. An acknowledge system and the fault display shall also be provided in HMI.

11.4.2 The HMI system shall indicate the movement of jack corresponding to a sequence. The monitor of HMI system shall depict the required dynamic graphics.

11.4.3 Whenever the travel motion of the machines is operated an audible alarm shall be operated through the operation of foot switch in operator's cabin.

11.4.4 All hooters & sirens shall be of robust industrial design. The make shall be approved by purchaser.

12.0 Limit switches & Junction boxes

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12.1 Heavy duty, roller lever, self reset type or rotary type, limit switches shall be used.

12.2 Enclosure class of all limit switches and junction boxes shall be IP-65.

12.3 Limit switches shall be suitable for operation in corrosive atmosphere.

12.4 Roller lever type limit switches shall be provided with 2NO+2NC contacts suitable for 240V, AC, 10A or 230V, DC, 2A.

12.5 Rotary type limit switches shall be provided with minimum 3 spare cams and contact arrangement. Contact rating shall be similar to roller lever type limit switches.

12.6 Non contact type Magnetic/proximity sensors for higher temperature shall be considered for various applications as per process requirement. The proximity sensor shall have suitable protective housing to withstand long term exposure to elevated temperatures up to +170 ^{0}C .Two nos. of LED should be provided with sensor for power indication and output indication.

12.7 Enclosure material for junction boxes, Local control station and field devices shall be minimum 1.6mm thick stainless steel.

13.0 Brakes

All brakes shall be of DC Electromagnetic, mill duty type only. Standalone brake panel shall be provided for each application.

14.0 Resistance Boxes

14.1 All resistances shall conform to IPSS:1-10-002-82. Punched steel grid resistances shall be provided. Resistance material shall be non-corrodible, free from brittleness. Typical material shall be AISI Grade 406 or Fechral (Cr 12 - 15 %, Al 3.5 - 4.5 %, rest Fe).

15.0 Light Fittings

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15.1 Lighting shall be provided in operator's cabin, panel room, platforms, walkways, stair cases, control desk, working area and any other area required for operation of machine.

15.2 All DPMCBs for lighting shall be provided in lighting distribution board in operator's cabin.

15.3 Fluorescent lamps shall be used for operator's cabin and panel room. Sodium vapour lamps shall be used for all other areas.

15.4 Suitable number of power socket outlets and hand lamp socket outlets shall be provided. A hand lamp with a plug and sufficient length of cable shall be provided with each machine.

15.5 Lighting panel shall be separately provided. Bulk-head type fittings with lamps shall be provided in platform and on the under frame of the car and high pressure sodium vapour lamps for flood lights shall be provided on the either side of the oven machines to illuminate the track and other areas. The light switches shall be provided inside the operator's cabin. Screw cap type holders and lamps shall be used for the car lighting.

15.6 Minimum 2 nos. of red revolving flash lights shall be provided on the car on both sides.

15.7 The lighting transformer shall have 50% reserve capacity. The lighting distribution board with metal clad switches incorporating MCBs shall be provided in the operator's cabin for the following:

- **Car lighting**
- **Fans**
- **Alarm Bell.**

15.8 Socket Outlet

Minimum of two numbers socket outlets for hand lamps shall be provided at operator's cabin, hydraulic cabin, MCC room and electronic panel room. Hand lamps shall be operated at 230V volts AC supply. Industrial type metal clad plug and sockets shall be provided.

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15.9 Suitable lighting transformer shall be provided for machine lighting. Minimum rating of lighting transformer shall be 7.5KVA.

16.0 Specification of Cables

16.1 All cables for power, control, lighting etc. shall be carried out with 1.1 KV grade heat resistant silicone rubber insulated flexible cable of copper conductor suitable for 150˚C. All power cables shall be minimum 4 mm2 (copper) and the control cables shall be minimum 1.5 mm2 (copper). The wiring inside the control panel shall be with PVC insulated stranded copper conductor. All flexible cables shall be multi-stranded copper. Single strand cables shall not be used any where inside the car. All cables exposed to direct heat radiation shall be of special insulation or shall run in formed steel channels provided with heat resistant material. Cables laid on open racks shall run in formed steel channels provided with heat resistant material. Cables laid on open racks shall be adequately clamped. Cables selection and routing on the car shall from a part of the car design.

16.2 GI pipes and pipe fittings if used on car for running cables, shall be of standard design and shall be supplied with complete accessories. Each motor shall be wired through separate pipe. All cables remaining live in open position of isolation shall be installed separately.

17.0 Identification of Circuits, Cables etc.

Adequate labels of permanent nature shall be provided as support of switches, fuses, contactors and relays etc. to facilitate identification of circuit and replacement. All panels, controller etc. are to be properly marked for each motor. All power, control, lighting and other cables are to be tagged at both ends as per cable number indicated in drawing. All equipment terminals are also to be marked like-wise. Only metal ferrules shall be used.

18.0 Earthing

All the electrical equipments mounted on the car shall be connected to the car structure by means of earthing links. The car structure in turn shall be made electrically continuous by providing jumpers over rivets or bolts. Equipment laid by flexible cable shall be earthed by means of spare core provided in the flexible cable. Earthing shall conform to "Indian Electricity Rules". Earthing shall be achieved through machine mass, rail and 4th earth

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conductor. Equipotential circuit shall be maintained. Copper wire of suitable cross section shall be used for earthing. Rubber matting shall be provided in operator's cabin. Earthing of all electronic equipment shall be as per the recommendation of supplier.

19.0 Air conditioning

19.1 All cabins, hydraulic rooms, electrical rooms and rooms housing electronic equipment shall be provided with air-conditioning equipments. Temperature inside Operator's cabin shall be 24±2°C, however inside the electronic & hydraulic cabins it shall be 35°C. Air conditioning equipment supply is not in the scope of the tenderer.

20.0 Variable Voltage Variable Frequency (AC Drives)

20.1 All drives requiring speed control shall be provided with AC drives depending on the type of motor selected. AC drives shall be provided for travel drives of oven machines, Ram beam drive and leveller drive of Pusher car etc. Pulse encoder shall be provided and hooked up with drives.

20.2 AC drives shall conform to the general specifications enclosed as Annexure.

20.3 The following AC drives shall be provided for each machine:

- **Two numbers of AC drives for travel mechanism of pusher car shall be provided each capable of driving all the travel drives. Normally both shall be operating, driving two sets of wheel drives. Pulse encoders shall be provided on wheels. Output of pulse encoders shall be hooked up to AC drives. Generally one drive with two motor shall be suitable for machine travel operation.**
- **Separate AC drives shall be provided for pusher beam, leveller drive for pusher car.**

20.4 Pulse encoders shall be provided for Ram beam drive , travel drive & Leveller drive. Analog output of pusher ram VFD panel (4-20 mA) shall be connected to PLC to monitor the pusher beam drive output control. Make of pulse encoders shall be HUBNER.

20.5 Enclosure class of AC drive panel shall be IP 42.

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20.6 All AC drives shall be provided with suitably rated reactors.

20.7 Minimum rating of AC drives & reactor shall be 180 % of the full load RMS current of the motor/group of motors. This shall be considered as the continuous current for the AC drives. Over load capacity indicated in the TS shall be based on the 100% continuous current indicated above.

20.8 AC drives shall be microprocessor based having communication facility with PLCs for data transfer and speed reference set point.

20.9 Software of drives shall be developed in such a way that after over voltage or under voltage when the drive trips, the AC drive shall be automatically resetted without any manual intervention after normalising of the voltage.

20.10 The AC drive system shall be independent of trolley line design system being provided by the purchaser and shall not effect the guaranteed performance of the drive system.

20.11 AC drive shall be provided with 1:100 speed range with dynamic braking.

20.12 AC drive panels shall be mounted on anti vibration pads.

21.0 Programmable Logic Controller (PLC)

21.1 Each oven machine shall be provided with PLC and HMI. The system shall be complete with CPU, I/O racks, memory, key board and monitor. HMI shall depict graphics of various mechanism operation and also provide alarm annunciation system. Stand by system with redundant CPU, power supply and communication processor shall be installed in the PLC panel. One PLC (co-ordinating PLC) shall be provided by purchaser at battery control room for data communication with machine PLC.

21.2 Communication between PLC and AC drive shall be possible for smooth operation of the machine. PLC shall have facility to communicate with Purchaser's RTU through serial communication.

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21.3 PLC shall perform the following task:

- **Logic interlock functions, control & supervision of drives & solenoid valves.**
- **Automatic sequential operation of various drives/devices like door handling mechanism, cleaner, pusher, charger, leveller etc.**
- **Status indication & signalling.**
- **Fault monitoring & annunciation.**
- **Diagnostic features based on logical rules to recognise and display faults.**
- **Communication with battery control room through digital radio link. (Hardware for digital radio link is in the tenderer's scope of supply.)**
- **Report generation.**

21.4 One number Laptop with programming software and drive parameterisation software for each machine shall be provided (included in tools and tackles – schedule 2)

21.5 Tenderer shall note that at every stage of design, engineering & software development purchaser & consultant shall be fully associated.

21.6 Software of the PLCs shall be developed in such a way that after voltage dip when all the I/Os are disabled, the same shall be automatically resetted without any manual intervention after revival of the voltage.

21.7 Enclosure class of PLC panel shall be IP42.

21.8 Tenderer shall provide suitably rated UPS for PLCs and its peripherals.

21.9 PLC shall conform to the general specifications enclosed as Annexure.

21.10 PLC panels shall be mounted on anti vibration pads.

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21.11 20 % spare I/O of each type shall be provided as spare.

21.12 Input interrogation voltage of PLC shall be 24 V DC. However, mixing of voltages shall not be allowed. Cabling and schemes shall be developed accordingly.

21.13 All outputs shall be relay outputs. Interposing relays shall be auxiliary contactors suitable for 240V, AC, 50 Hz, 6A. DC rating of contacts shall be 2A. 10 % spare interposing relays shall be provided.

22.0 Particular Requirements

22.1 Sizing of electrical premises shall be done as per the requirements indicated by Purchaser/consultant.

22.2 The Tenderer shall take all the necessary steps to get the installation approved by statutory Government Authorities like Electrical Inspector, Factory Inspector, Insurance Official etc. Necessary assistance in form of application and payment of Government fees shall be rendered by Purchaser in this regard. Modification suggested by statutory authorities in equipment or installation shall be carried out by Tenderer at no extra cost to the Purchaser.

22.3 Tenderer shall supply current collectors to be provided on the oven machines as per the design of trolley line system being provided by the Purchaser. Details of the same shall be given to the Tenderer during detailed engineering. No additional claim on this account shall be entertained by the purchaser.

22.4 Performance guarantee for electrical equipment shall ensure that all the electrical equipment in a subsystem/system shall be capable of performing as per the specified and approved performance parameters of subsystem/system. However every electrical equipment shall also be capable of individual performance as per design as well as name plate details. This shall be demonstrated by the Tenderer to the satisfaction of the purchaser/consultant.

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22.5 Make of equipment shall be as per TS. Prior approval of purchaser/consultant shall be taken for make of equipment not indicated in TS.

22.6 Enclosure class of the equipment shall be as per TS.

22.7 Training of purchaser's personnel for drives(20 mandays) & PLC(20 mandays) shall be arranged at the tenderer's desigrated premises free of charge.

22.8 AC drives panels, PLCs and its peripherals, MCC, LDB, control desk shall be mounted on anti vibration pads. Any other equipment sensitive to vibrations shall also be mounted as indicated above.

23.0 Tests

All routine and site tests shall be carried out strictly as per Specification and IS/IPSS/International Standards. Type test certificates shall be furnished for similar equipment. In case the type test certificates are not available, the same shall be conducted in Purchaser's presence, if the Purchaser desires, at no extra cost to the Purchaser.

24. Drawings & Documents

24.1 Information/data/drawings to be furnished for Electrics by the Tenderer for approval

24.1.1 Basic engineering

- **Single line diagrams of MCCs, PDBs, MLDBs, LDBs etc.**
- **Power control and regulation schemes of AC drives.**
- **Layout of electrical rooms and control rooms including ventilation air conditioning and handling facilities.**
- **Layout of electrical equipment in electrical premises & operator's cabin.**

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- Voltage drop calculations for incoming power cables & outgoing power cable for motor.
- Quality Assurance plan for various equipments.
- List of motors, limit switches & other field equipments.
- Maximum demand calculation for each MCC, PDB, MLDB etc.
- Motor rating & AC drive rating selection & calculation.
- List of drawings.

24.1.2 Detailed engineering

- Single line diagrams with ratings for MCCs, PDBs, LDBs etc.
- Bill of materials with technical specification.
- General arrangement drawings with complete dimensions and list of inscriptions for all equipment.
- Power and control schemes for protective panel and other drives with bill of materials, technical specification, type/make, etc.
- Power, control & regulation scheme for AC drives and UPS.
- Automation configuration with control philosophy write up indicating control, interlocking and automation details.Functional description of drives & interlocks.
- List and details of hardware with specifications.
- G.A drawings of panels.
- Power supply scheme.
- List of I/Os, Block Logic Diagram and BOQ of PLC
- Hard copy of software.

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- **Layout drawings.**
- **Layout of electrical equipment on the oven machine.**
- **Equipment & cable layout in electrical premises and control/operator rooms with sectional views.**
- **Layout of cable trays/structures, GI pipe layout and cable layout on the machine with sectional views.**
- **Battery and UPS capacity calculations.**
- **Motors and field devices**

- **G.A drawings.**
- **Technical data sheet.**

- **Cable specification.**

24.1.3 Illumination

- **Single line diagrams with ratings of power components for LDBs.**
- **Bill of materials with technical specificationof equipment/component /fittings.**
- **Illumination layout containing the type and rating of all equipment with list of the luminarie for the machines.**

24.2 Information/data/drawings to be furnished by the Tenderer for reference

- **All drawings and documents approved by MECON.**
- **Terminal plan drawing for all equipment.**
- **Cable schedule.**
- **Interconnection diagrams.**

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- Layout of earthing system for the equipment.
- Technical particulars, catalogues, literature etc.
- Consolidated bill of materials for erection & installation items like GI pipes & fittings, cable trays, earthing materials etc.
- Spare parts list & drawings.
- Instructions for storage/erection, testing & commissioning.
- Operation & maintenance manuals.
- Final test certificates from suppliers and site tests.
- As built drawings.

24.3 **Information/data/drawings to be furnished by the Tenderer as final technical documentation.**

- All drawings, documentation and calculations indicated above.
- List of drawings & drawing numbering system explanation.
- Motors & field devices :
- Speed-torque, current vs. time, thermal withstand characteristics for motors.
- List of interfaces between the Tenderer's equipment and Purchaser's equipment.
- Internal wiring diagrams of equipment.
- Illumination
- Schedule of equipment with their location
- Connected load and maximum demand for machines.

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- **Cable schedule.**
- **All approved drawings.**
- **Internal layout and wiring diagrams of all panels.**
- **All as built drawings.**
- **Technical specification/ data sheets of equipment and light fittings.**

24.4 **Drawings/documents for inspection of electrical equipment**

- **Type test certificate for identical equipment.**
- **Sub-supplier's or vendor's catalogues, technical literature.**
- **Test reports and internal inspection report by Tenderer.**
- **Test certificates of components/equipment.**
- **Technical specification & data sheets of equipment.**
- **All "Approved" drawings.**

25.0 Make of Electrical Equipment

1. **Due consideration shall be given to inventory control, inter-changeability, trouble shooting etc. in design and selection of equipment and controls.**
2. **Efforts shall be made to offer maximum indigenous electrical equipment.**
3. **Make of all indigenous electrical equipment shall be selected out of Purchaser's "Preferred Makes of Equipment and supplies".**
4. **Make of all imported electrical equipment shall be selected in consultation with the Purchaser.**

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5. In case make for some of the equipment/components are not indicated in the Purchaser's "Preferred Makes of Equipment and supplies" then the same shall be finalised in consultation with Purchaser/Consultant.

6. In case the electrical equipments are imported, these shall be tropicalised. It shall be ensured that the components used are also available from Indian sources. Sufficient spares shall be supplied for imported equipment/ components.

7. Tenderer shall ensure against the OBSOLESCENCE of equipment under their scope of supply for a minimum period of 10 years. The Tenderer shall also guarantee that discontinuity of production of any item offered as part of the system shall not affect the maintainability of the system. The Tenderer shall submit an undertaking to this effect along with the offer.

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26.0 Preferred Makes

a)	Make of motor	:	ABB/KIRLOSKAR/CGL/BB/ALSTOM/ SIEMENS/ BALDOR
b)	Make of panels	:	RITTAL/BCH WITH APPROVED COMPONENTS
c)	Brake (DCEM)	:	BCH
d)	MCCB	:	GEPOWER/SCHNEIDER/ABB/SIEMENS.
e)	Contactor	:	ABB/SCHNEIDER/L&T/ SIEMENS/GEPOWER/BCH.
f)	Thermal O/L Relay	:	SIEMENS/BCH/SCHNEIDER/L&T/C&S/ GEPOWER /ABB
g)	EMPR	:	LG/SPECHER&SCHUH/BCH/SIEMENS
h)	Selector switch/ push button indicating lamp	:	SIEMENS/BCH/GEP/KAYCEE/ABB
i)	Limit switches	:	EPCC (KAKKU) / AG MECHANICAL
j)	MCB	:	MDS/STANDARD/SCHNIDER/ ABB/SIEMENS
k)	Meters	:	MECO/IMP
l)	Lighting fixtures	:	PHILIPS/ CG/BAJAJ
m)	HRC Fuses	:	GEPC/SIEMENS/L&T
n)	Master controller	:	SCHNEIDER / SIEMENS / STROMKRAFT

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o)	PLC	:	ROCK WELL/ABB/SCHNEIDER/SIEMENS
p)	AC Drives	:	ABB / SIEMENS / L&T / ROCKWELL AUTOMATION/ SCHEIDER / HITACHI / NELCO
q)	Weighing system	:	SCHENCK/ SARTORIOUS/TRANSWEIGH
r)	Encoders	:	HUBNER
s)	Proximity & Photo Electric sensor	:	ROCKWELL/SCHNEIDER/SIEMENS

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27.0 List of drawings.

These drawings shall be furnished by the tenderer during detail engineering. Approval of drawings from DSP/ MECON shall be responsibility of tenderer.

Sl. No.	Description	Project Drg. No.	Category
1	Electrical schematic & BOM	DSP/HEC/14/02/01/COB-43B/DE/00010	Approval
2	GA of Control Panel	DSP/HEC/14/02/01/COB-43B/DE/00011	Approval
3	GA of Control Desk	DSP/HEC/14/02/01/COB-43B/DE/00012	Approval
4	GA of PLC panel including HMI	DSP/HEC/14/02/01/COB-43B/DE/00013	Approval
5	GA of Local Control Post	DSP/HEC/14/02/01/COB-43B/DE/00014	Approval
6	GA of Terminal Box	DSP/HEC/14/02/01/COB-43B/DE/00015	Approval
7	Motor GA Drawing & data sheet with curve	DSP/HEC/14/02/01/COB-43B/DE/00016	Approval
8	DC Brake GA Drawing	DSP/HEC/14/02/01/COB-43B/DE/00017	Approval
9	Brake Rectifier Panel, GA, BOM & schematic	DSP/HEC/14/02/01/COB-43B/DE/00018	Approval
10	Cable Selection Chart	DSP/HEC/14/02/01/COB-43B/DE/00019	Approval
11	Data Sheet of all cables	DSP/HEC/14/02/01/COB-43B/DE/00020	Approval
12	Data Sheet of lighting fixtures	DSP/HEC/14/02/01/COB-43B/DE/00021	Approval
13	UPS-GA, schematic & BOM with battery	DSP/HEC/14/02/01/COB-43B/DE/00022	Approval

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	sizing		
14	Data Sheet of Limit Switches (Proximity switches)	DSP/HEC/14/02/01/COB-43B/DE/00023	Approval
15	Data Sheet of Laptop & Printer	DSP/HEC/14/02/01/COB-43B/DE/00024	Approval
16	PLC I/O List	DSP/HEC/14/02/01/COB-43B/DE/00030	Reference
17	Equipment Layout drgs	DSP/HEC/14/02/01/COB-43B/DE/00031	Reference
18	Cable layout drgs.	DSP/HEC/14/02/01/COB-43B/DE/00032	Reference
19	External connection diagram	DSP/HEC/14/02/01/COB-43B/DE/00033	Reference
20	Cable Schedule	DSP/HEC/14/02/01/COB-43B/DE/00034	Reference
21	Control philosophy	DSP/HEC/14/02/01/COB-43B/DE/00035	Reference

1.0 SCHEDULES

SCHEDULE-1

1.1 LIST OF COMMISSIONING SPARES

SL.NO.	EQUIPMENT	DESCRIPTION OF SPARE	QUANTITY REQUIRED	REMARKS

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1	Contactor Coil		1 no for each rating	
2	Push Button		2 nos.	
3.	Bulb for signal lamp		5 nos.	
4.	Proximity switch		2 nos.	
5.	AC incoming fuse for VVVF drive		1 set for each rating	
6.	DC Link Fuse for VVVF drive		1 set for each rating	
7.	Input/Output card		1 set for each rating	

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SCHEDULE-2

1.2 SPECIAL TOOLS, TACKLES AND INSTRUMENTS

SL.NO.	NAME OF EQUIPMENT	DESCRIPTION OF TOOLS/TACKLES/ INSTRUMENTS.	QUANTITY RECOMMENDED	REMARKS
1		**2.5 kV Hand wound megger**	**1 no**	
2		**3 ½" Digital Multimeter**	**1 no**	
3		**Laptop with latest configuration and licenced software.**	**1 no**	

NOTE:-

The above list is indicative. The Tenderer shall provide the complete list during BE/DE stage.

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SCHEDULE-3

FORMAT FOR LT MOTOR DATA SHEET

1.	MAKE	:
2.	DRIVEN EQUIPMENT TAG NO.	:
3.	MOTOR TAG NO.	:
4.	QUANTITY	:
5.	VOLTAGE WITH VARIATION	:
6.	NO. OF PHASES/CONNECTION/	:
	NO. OF TERMINALS	
7.	FREQUENCY WITH VARIATION	:
8.	FAULT LEVEL (MVA) & DURATION	:
9.	MOTOR TYPE & DUTY	:
10.	KW RATING/POLE	:
	* AT 40 DEG. C.	:
	* AT SPECIFIED AMBIENT TEMP	:
	WITH DERATING.	
	* BHP/BKW OF DRIVEN EQPT.	:
	AT RATED LOAD	
11.	FRAME SIZE/MOUNTING	:
12.	INSULATION CLASS WITH TEMP. RISE	:
13.	ENCLOSURE TYPE	:
14.	FULL LOAD SPEED	:
15.	FULL LOAD TORQUE (FLT)	:
16.	STARTING TORQUE AS % OF FLT	:
17.	PULLOUT TORQUE AS % OF FLT	:
18.	FULL LOAD CURRENT (FLC)	:
19.	STARTING CURRENT AS % OF FLC	:
20.	STARTING TIME ON RATED LOAD	
	* AT RATED VOLTAGE	:
	* AT 75 % OF RATED VOLTAGE	:
21.	LOCKED ROTOR WITHSTAND TIME	
	* COLD	:

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	* HOT	:
22.	DIRECTION OF ROTATION	:
23.	GD SQUARE OF MOTOR	:
24.	GD SQUARE OF DRIVEN EQPT.	:
25.	POWER FACTOR AT	
	* 50 % LOAD	:
	* 75 % LOAD	:
	* 100 % LOAD	:
26.	EFFICIENCY AT	
	* 50 % LOAD	:
	* 75 % LOAD	:
	* 100 % LOAD	:
27.	SPACE HEATER WATTS/VOLTS	:
28.	TERMINAL BOX TYPE &	:
	NO. OF TERMINALS	
29.	FOR SLIP RING MOTORS	
	* TYPE AND NO. OF RTDs	
	FOR WINDINGS	:
	* STATOR/ROTOR TIME CONSTANT	:
	* ROTOR CURRENT AT FULL LOAD	:
	* ROTOR VOLTAGE	:
	* ROTOR RESISTANCE	:
30.	NO. OF STARTS PER HOUR	:
31.	COOLING	:
32.	APPLICABLE STANDARD	:
33.	APPLICABLE SPECIFICATION	:
34.	LOCATION	:
35.	HAZARDOUS AREA CLASSIFICATION	:
36.	BEARING TYPE NO.	:
37.	LUBRICATION TYPE	:
38.	CABLE SIZE	:
39.	WEIGHT IN KG.	:
40.	G.A., DIMENSIONS & MOUNTING	: YES/NO
	DETAIL DRAWINGS ENCLOSED	
41.	DETAIL DRAWINGS FOR TERMINAL YES/NO	:

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	BOX	
42.	**PERFORMANCE CHARACTERISTIC CURVES**	**: YES/NO**
	VIZ. SPEED V/S CURRENT & SPEED	
	V/S TORQUE ENCLOSED	

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SCHEDULE-4

STANDARD SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER

PROGRAMMABLE LOGIC CONTROLLERS:

Monitoring and control of Oven Machines operation shall be Programmable Logic Controller (PLC) based.

The equipment shall confirm to the standards developed by the Inter plant standards for steel industry IPSS:2-07-015-93 and relevant standard of Bureau of Indian standards (BIS) as applicable. Where IPSS / BIS do not exist, the components of all equipment shall be de-signed, manufactured, assembled, tested and installed in accordance with the latest standards of IEEE/NEMA/IEC or National standards Institution of the country where they are manufactured.

1.1 General Features

The PLC system shall be so designed that it is completely reliable and availability of the system shall be better than 99%. The PLC system shall be most versatile, expandable, rugged, microprocessor based. The hardware shall be designed using advanced technology which shall bring a high level of capability, reliability and quality in the system. The PLC system shall comprise of processor I/O unit, multiplexers, A/D converters, communication electronics, CPU, Power Supply Modules, Memories for CPU; bus system, operators' console with peripherals, interfacing equipment, marshalling / field termination racks, desks, panels etc. The input/output channels shall be provided with isolation.

On-line replacement of any module shall be possible in such a way that the removal and addition of any module shall be possible without de-energizing the system. Further there shall not be any interruption in the system while replacing a faulty module except for the inputs/outputs which are being handled by the module.

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Operation of PLC shall be completely unaffected by a momentary power loss of the order of 20 milliseconds.

The system shall have extensive set of self diagnostics hardware and software features with alarm facility for easy and fast maintenance. Diagnostics shall be required at local as well as in console level for identification of fault location.

1.2 Environmental Classification

The equipment shall be suitable for continuous duty under the following conditions:

- **Temperature while operating :**

  lower limit : 0 degree C
  Upper limit : 55 degree C

- **Temperature while not operating (storage)**

  lower limit : 20 degree C
  Upper limit : 70 degree C

- **Relative humidity**
- **Daily average 80 to 90% (10 h) and 65 to 90% (16 h)**
- **Maximum 98%, not occurring simultaneously with maximum temperature.**

1.3 Basic design particulars

Power Supply Units

- **Plug in Modules as required for CPU / IO cards mounted on respective Racks**
- **Power supply for CPU Rack**
- **24V Power supply Units for I/O interrogation and field instruments**

PLC System

- **Communication modules for Communication between PLCs, AC drives, DCS, Level2 system radio communication data exchange system and with field devices.**

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- **CPU Capable of handling PID functions and weighing and batching functions.**

Memory

- **EPROM / EEPROM**
- **RAM with battery backup**

Input units

- **Discrete inputs**
- **BCD inputs**
- **Analog inputs (configurable for mV, mA, T/C of various types, RTD)**
- **Pulse inputs (Incremental encoder / digital tacho)**
- **Absolute encoder inputs (gray code)**

Output units**:**

- **Discrete outputs for driving interposing output relays**
- **BCD outputs**
- **Analog outputs (4 – 20mA / 0 - 20mA)**

Timers **From 10 milliseconds to few hours, Accuracy (+/-)0.1%**

Counters **Count from 0000 to 9999 Up / Down**

1.4 Power Supply System

- **415 V, 3 phase, 4 wire, 50 Hz solidly earthed neutral system.**
- **Symmetrical fault level 50 kA, rms**
- **Voltage variation : + 10% / -15%**
- **Frequency variation: +4% / -6%**

1.4.1 Built-in power supply units

- **Suitable for the power supply system as specified above.**
- **Insulation level 2.5 kV for 1 minute.**
- **Protective features:**
- **Surge voltage protection**
- **Fuse protection in the input and output circuits**
- **Electronic over current protection**

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- Thermostat protection against over temperature
- Independent units for the following :-
- For CPU and associated electronic units
- For sensing the status of input devices
- For powering field transmitters through respective input cards
- For driving outputs

1.5 Central Processing Unit (CPU)

- Modular and plug-in type
- Central processor 32 or 16 bit microprocessor based
- Single / multiple processors in coordination
- Shall be capable of handling 30 % additional (future) I/Os over and above 20 % spares (installed) I/Os indicated in basic configuration diagram.
- PLC shall be capable of handling weighing and batching loops
- Maximum CPU loading shall be limited to 60 % for the intended applications
- Scan time between 2 m sec to 5 m sec per one K instructions or better
- Provision to latch desired outputs

1.6 Memory

1.6.1 Program memory: Formatted data shall be stored in EPROM / EEPROM or battery operated backed RAM. These memories shall be backed up by floppy disks.

The general technical features of the memories shall be as follows:

- Modular and plug-in type
- Word length 8 bit/16 bit
- Expandable in blocks
- Minimum size 16K
- Data and application program memory sized to have at least 40% free memory space.
- EEPROM / RAM with battery back-up
- Back-up battery shall be as follows:
  - Rechargeable Ni-Cd batteries with necessary charging circuit / Lithium batteries of suitable capacity.

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- **Able to sustain memories for a minimum of 14 days with no power applied to the controller.**

1.7 Process Input / Output (I/O) Units

This unit shall provide the main interface between field devices, PLC and HMI system. This shall provide necessary slots / racks with complete wiring for installing the input / output cards for analog and logical I/Os and the controller connection. The field cables shall not be brought directly to the I/O cards. The same shall be routed through the field termination / marshalling racks. All wiring inside racks / cabinets / back of the panels shall be housed in covered nonflammable plastic raceways arranged to permit easy accessibility to various equipment for work and maintenance. The signal validity check, ambient temperature compensation for mV inputs from thermocouples and broken sensor check shall be necessarily a built-in feature for analog input cards. 20% I/O slots (installed) and 20% I/O cards (at least one card of each type minimum) shall be kept spare.

Separate power supply unit shall be provided for individual I/O rack and processor. Suitable battery back-up shall be provided for volatile memory protection.

Each I/O shall be electrically isolated from external control circuit by suitable means. The minimum isolation level between I/O and logic circuit shall be 1500 V dc.

Each I/O shall be protected against the reversal of polarity of the power supply voltage to I/O.

1.7.1 Input Units

- **Modular and plug-in type**
- **Insulation level of 1.5 kV**
- **Individual fuse for each unit shall be provided for protection against cable fault/earth fault.**
- **Input interrogation voltage 24V DC (built-in) preferable.**
- **LED status indication**

Inputs shall be suitable for accepting the following:

- **Discrete input units shall have the following:**

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- Time delay of about 10 millisecond to filter out noise and contact bounce.
- Optocoupler to galvanically isolate each input device from the decision making logic of the controller

- BCD input units suitable for four digit input
- Pulse inputs (Incremental encoder / digital tacho)
- Absolute / incremental encoder inputs

- Analogue input units shall be as follows:

- With necessary A/D converter having 12 /14 bit resolution.
- Suitable for 4 - 20mA / 0 - 10V DC inputs (with 24 V dc power supply facility in each card for the field transmitters, excepting one input card where this loop power supply facility is not required)
- Suitable for PT100 2- wire / 3 wire
- With insulation level of 1.5 kV
- Each input shall be galvanically isolated.

1.7.2 Output Units

- Modular and plug-in type
- Discrete output units shall be as follows:

- Isolated output with two separate terminals for each output.
- All outputs shall be through separate relays rated for 24V DC, 2A, 50 Hz (15A for 50 milli-second to take care of the in rush current of the contactor coil).
- Galvanically isolated by opto coupler
- With LED status indication
- With insulation level of 1.5 KV
- Output relays shall have surge suppressor across them. Card mounted relays are not acceptable.

- BCD output units shall be as follows:

- Suitable for four digit output
- Rated to drive seven segment displays used
- With insulation level of 1.5 kV

- Analog outputs shall be as follows:

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- **Suitable for 4 - 20mA / 0 - 10V outputs**
- **With necessary D/A converters having 12/14 bit resolution**
- **With insulation level of 1.5 kV**
- **Each output shall be galvanically isolated.**

1.8 Programming Unit

- **Laptop shall be provided for programming.**
- **With facility for loading the programme developed on EPROM and CD.**
- **Capable of ON line & OFF line programme development with necessary hardware interface and software.**
- **Facility for simulation test and programme debugging with necessary software.**

1.9 Self diagnostic features

- **Parity errors, cycle errors and under voltage**
- **Failure in central processor unit, memory and power supply.**
- **Communication failures – all types**
- **Indication of type of failure**
- **Automatic turning OFF of all outputs or optionally holding of all outputs in their last state on failure detection.**

1.10 Terminations

- **All inputs and output wired upto easily accessible terminal blocks rated for 660V.**
- **Screened cables for milli-Volt signals from I/O rack to terminal block.**
- **Compensating cables for thermocouple signals from I/O rack to terminal block (with copper terminals).**
- **Suitable for terminating upto 2.5sq. mm. copper conductor industrial control cables.**
- **Fuse terminals for all output signals.**

1.11 Additional Features

- **Fully programmed**
- **Connection of field devices with input units through ordinary multi core copper control cables.**

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- **Communication with computer in distributed hierarchical control system and operator consoles/display units.**
- **Printers to get hard copy of the programme developed / process information / reports.**

1.12 Earthing

Separate earthing bus for power / panel earthing and electronic earthing shall be provided.

Electronic earthing bus shall be suitably insulated. Earthing requirements / earthing schemes for the equipment supplied shall be clearly indicated in appropriate drawings.

1.13 Special Features

i) The PLC system shall be immune to the following:

- **Radio frequency interference**
- **Electromagnetic interference**
- **Power system spikes**

The methods and standards followed for these features shall be furnished along with the tender.

1.14 Other features

- **Test sockets on input modules for input simulation**
- **Suitability for On-line replacement of I/O cards without switching of power supply**
- **Switch to disable all outputs of the controller during start-up/debugging**
- **Fuse failure indication for outputs**
- **Provision to connect VDU/Printer for alarm annunciation to accept set points, data display and logging**
- **mA Ammeters to be mounted on the front panel for leakage current measurement during earth fault of input and output power bus .**

2.0 Constructional Features

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- **Unitised construction**
- **Sheet steel clad**
- **Floor mounted, free standing and indoor type**
- **cable entry provision from bottom**
- **Panel illumination to be provided with door interlock limit switch**
- **Dust and vermin proof**
- **suitable anti-vibration pads to withstand vibrations**
- **All modules plug-in type**

Enclosure

- **Conforming to IP-42 class, for equipment located in air-conditioned room.**

Painting

The sheet metal parts shall be subjected to the following pre-treatment before final painting.

- Degreasing
- Pickling for complete rust removed
- Phosphating
- Corrosion resistant primer painting.

Final coats of spray paints shall be given as per shade No.631 as per IS 5, 1995.

3.0 Mounted Spares

- **Min of 20 % of I/O modules used with at least one module of each type for input and output shall be offered as spare for each programmable controller and the same shall be mounted and wired to the terminal block in the cubicle suitably.**
- **Provision shall be provided with empty slots for future expansion for 20% I/O modules.**
- **Minimum 50 % spare memory capacity shall be built in the system after loading of application and system software.**

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4.0 Miscellaneous requirements for programmable controllers

- **Programmable controllers shall be suitable for normal industrial environment though they shall be housed in air-conditioned rooms.**
- **Table top mounted printer shall be provided.**
- **Separate furniture (Printer tables) shall be provided for the above printers.**
- **Cassettes/CDs loaded with frozen program of each PLC shall also be supplied. These shall be properly identified and housed on cubicle for ready use.**

5.0 SOFTWARE:

a) **PLC Programming software – 1 no for each machine.**

b) **HMI software – 1 no for each machine.**

HUMAN MACHINE INTERFACE

The Human Machine Interface shall be through the touch screen. PLC will be communicating directly with HMI. All the data updating taking place in the PLC will be updated in HMI. High resolution colour touch screen monitor will be provided. Sequence of various mechanism operation will be controlled and displayed on screen including alarms.

i) Printer

The workstation shall be connected with laser printer.

The mounting of the printer shall be on separate tables. The tables shall be supplied along with printers. The noise of printers at 1 meter distance shall be less than 65 dB.

Tests

The following tests shall be carried out on PLCs in the presence of purchaser / representatives:

- **Visual inspection test.**
- **Over all dimensions, component, mounting, and wiring.**

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- Quantity checks for no. of I/O modules, peripherals etc.
- Insulation test.
- Temperature test (ageing test).
- Mechanical vibration test.
- Noise immunity test.
- Bill of materials.
- Functional tests :
  - Of CPU, programming unit, power supply, I/Os.
  - Test of all fault diagnostic features of PLC.
  - Checking of operation of each I/O port, timers.
  - Running of a test and actual programme, transfer of data to and from VDU key board unit and driving of printer.
  - Integrated functional test with all equipment and peripherals connected as per configuration diagram.

Cables

All necessary special cables with connectors required for interconnection of the different units of the above system shall be included in the scope of work.

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SCHEDULE-5

STANDARD SPECIFICATION FOR VARIABLE VOLTAGE VARIABLE FREQUENCY CONVERTERS (AC DRIVES)

VARIABLE VOLTAGE VARIABLE FREQUENCY DRIVE

1.0 BASIC DESIGN PARTICULARS

All VVVF Drives shall have Digital Control Technology with Vector control. VVVF shall communicate with PLC.

- **Input Voltage : 415V +10% to –15% , 3 phase neutral earthed system.**
- **Input Frequency : 50 Hz +4%, -6%**
- **Output Voltage : 3-Phase, 415 V max. at nominal input .**
- **Output Frequency : Can be selected to suit the motor operating frequency range for constant torque and constant power**
  1-50 Hz (Constant torque)
  50-100 Hz (Constant power)
- **Rated output current: Minimum 180% of full load RMS Current of motor/ group of motors for intended application**

1.1 Type of connections

- **Three phase frequency converters with rectification and inversion i.e. variable voltage and variable frequency output with current source / voltage source (PWM) inverters.**
- **Line reactors /Isolation transformers for harmonic and noise suppression.**

1.2 Overload capacity

- **150% of the rated inverter current for 1 minute following 100% load & to meet the drive overload capacity.**

1.3 Other Features

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- **Efficiency more than 95% at full load.**
- **Suitable to withstand vibrations more than 0.5 g.**
- **Ramp rate : Linear acceleration and deceleration adjustable independently.**
- **Set point for torque adjustable independently.**

2.0 Power components:

The main power components of the VVVF equipment shall have the following equipment on incoming AC side:

- **Matching reactor.**
- **AC line surge suppression network.**
- **ACB/MCCB**
- **Input contactors**
- **Line contactors**

2.1 Load side

- **Filter network**
- **Output side reactor.**
- **Isolator and over-load relay for each motor.**

3.0 Principle Controls – Minimum Requirements :

- **IGBT Power Technology**
- **PWM with Programmable career frequency**
- **Reference speeds setter (SW selectable)**
- **Torque / Power mode**
- **Slip compensation control**
- **V/f control**
- **Speed feed back, as required**
- **Current feed back**
- **Dynamic current control**
- **Programmable proactive current limit**
- **Independently programmable acceleration & deceleration times (Minimum 2 each)**
- **Independently programmable Torque set points.**
- **Zero speed / over speed monitor as applicable**
- **Dynamic braking Chopper unit with resistance.**

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- **Facility to accept speed reference and other control from programmable controller through communication network.**

4.0 Protective features

- **AC line surge suppression network**
- **Under voltage in supply network**
- **Phase sequence protection and monitoring**
- **Under voltage in DC link**
- **Over voltage in DC link**
- **Over speed monitor**
- **Overload**
- **Earth fault**
- **Instantaneous over current**
- **Transformer faults**
- **Cooling fan failure**
- **Stall monitor for motor**
- **AC mains failure**

5.0 INPUTS

ANALOG INPUTS

(a) Frequency Setting 0-10 V DC ; 4 - 20 mA
(b) Position feedback

DIGITAL INPUTS

(a) Reset	:	For fault reset & instantaneous output cutoff (Normally Closed)
(b) Forward / Reverse run	:	Selectable individually.
(c) Multistage speed / Torque	:	Four kinds of speed settings including main speed setting shall be selectable.
(d) Jogging Operation	:	Selectable from 0 to 9.9 Hz Mode selection by digital input
(e) Stop	:	Coast to zero command
(f) Pulse inputs	:	From digital tacho / BCD from position encoder / Encoders (Incremental & absolute)

6.0 OUTPUTS :-

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ANALOG OUTPUT

(a) Frequency monitor	:	0-10 V DC signal proportional to output frequency for driving analog meter.

DIGITAL OUTPUTS

(a) Fault alarm relay	:	Relay with change over contact available for annunciating inverter fault.
(b) Drive running signal	:	output (24V DC) for driving externally connected relays.
(c) Frequency arrival signal	:	Output (24V DC) for driving externally connected relays.
(d) Annunciator outputs	:	Contact outputs for annunciating various inverter panel faults in lighted windows.

7.0 Constructional Features

- **Floor mounted, free standing**
- **Dust and vermin proof**
- **Sheet steel clad**
  - **Minimum 2.5 mm thick for panels.**
  - **Minimum 2.0 mm thick for doors and side covers**
- **ISMC 75 base channel at the bottom.**
- **Suitable to withstand vibrations to be encountered in steel plant applications.**
- **Provided with anti vibration Pads**
- **Cubicles with illumination lamps, door switches, space heaters and adequate sockets for connecting instrument, soldering iron etc.**
- **All control blocks plug-in-type with necessary test sockets.**
- **Units shall be self contained and serviceable.**

8.0 Enclosure and Ventilation

- **Enclosure conforming to IP-42.**
- **Units shall be provided with cooling fans and louvers at the bottom sides. All louvres shall have fine mesh behind them.**

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- **Ventilation through individual ventilation ducts, from bottom not acceptable.**
- **Ambient temperature shall be 55ºC .**

9.0 Test

a) The following tests shall be carried out at works in the presence of purchaser's representative:

- Visual inspection
- Insulation test
- High voltage test
- Functional test
- Light load test
- Full load and temperature rise test

b) The following tests shall be performed at site :

- Visual inspection
- Insulation test
- Functional test
- Light load test

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SCHEDULE-6

STANDARD SPECIFICATION FOR L T INVERTER DUTY MOTOR

Sl.No.	Parameters	Description
1.0	Type	- **AC Squirrel cage induction motor.** - **Inverter Duty**
2.0	Standard	- **IPSS 1-03-001/ IS 325** - **NEMA Standard MG1-1993 Part 31, or the latest revision in so far as it is applicable.**
3.0	Constructional Features	
A	**Frame size & rating**	- **As per IS 325** - **10:1 constant torque speed range motors may exceed frame standard by one frame rating.**
B	**Motor body**	**Grey iron casting as per IS:210-1978**
C	**Motor Feet**	**Integrally cast with the stator**
D	**Body Design**	- **Prevent breakage or other failures due to vibrations normally encountered in heavy industries .** - **Motors shall be of weather proof construction.** - **Designed to operate in the humid air stream .**
E	**Protection for Motor & Bearing**	**IP - 55** **(with canopy for motor)**
F	**Motor Shaft**	**Shall be provided with an external recessed slinger at the drive end of the motor to provide additional (minimum**

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		IP-54) protection from moisture and foreign material.
G	Shaft ends & Extension	- Cylindrical as per requirement - Shaft shall be extended for encoder / tacho. mounting, accordingly suitable hole shall be drilled and tapped .
H	Internal Encoder	Motors with speed variation of 1000:1 at constant torque shall have internal built in encoder for speed feedback.
I	Bearing	- Roller type bearing upto 5 kW. - Ball Bearing at NDE end for above 5 kW. - All motors shall have fully re-greasable, anti-friction bearings. - All motors shall have cast iron inner bearing caps. - Bearings shall be oversized . - All motors shall have a charged lubrication system to inhibit moisture condensation. - Standard motors shall have extended grease fittings on the opposite drive-end to facilitate re-lubrication. Grease ports shall be located on the periphery of the motor end shield. - Motor shall be fitted with a shaft slinger or V ring seal on the drive end for a minimum of IP-54 protection (to help protection of bearing from ingress of dust, dirt or fluids)

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J	Hazardous Area safety design	As per process requirement
4.0	Terminal box	
A	Location	RHS viewed from DE / On top
B	Suitability	- 4 Core Aluminium Cable - The terminal box shall be oversize as compared to NEMA requirements.
C	Rotation	4 X 90 deg.
D	Earthing stud	Inside Terminal Block
E	Miscellaneous	- Shall be gasketed between the terminal box halves. - The conduit box shall be field convertible to cast iron. - External screws and bolts shall be grade five, hex heads and be plated to resist corrosion.
5.0	Cooling	- TEFC, Effective bi-directional - Motor with 1000:1 speed range and constant torque shall have external fan. - External fan motor shall be 3 phase , 440 V AC - Thermistors shall be provided in the windings.
6.0	Quality of operation	
A	Vibration intensity	- Shall be limited as per IS 12075-1986. - Shall not exceed .08 inches / second velocity.
B	Noise level	As per IS: 12065-1987

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7.0	Electrical design	
A	Power Supply	415 V +10% / -15%, 3-phase, 50 Hz + 4%/-6% , 4-wire AC, 50 kA for 1 second, solidly earthed.
B	Starting	Variable Frequency Drive
C	Service factor	- 1.0 for VFD power . - 1.15 for sine wave power .
D	Peak transient voltage	1500 V
E	Minimum rise time	0.1 microsecond
F	Starting Torque	200 % rated torque for 1 minute below base speed
G	Constant horsepower operation	1.5 times base speed .
H	Duty	Application dependent
I	Max speed permissible	150 % rated for 2 minutes
J	Derating for VFD	As per above mentioned standard
K	Insulation	- Minimum Class H - Insulation materials with additional phase insulating material, extra end-turn bracing and Class H spike resistant wire.
L	Load Type	Constant Torque / Variable Torque (As per application)
M	Space Heater	- Out door motors above 45 kW - Indoor Motor above 110 kW

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N	Temperature Rise	Limited to Class F
O	No. of Poles	6 / 8
8.0	Operating Characteristics	
A	Operation with variation in the voltage or the frequency	Motors shall operate successfully under running conditions at rated load with variation in the voltage or the frequency not exceeding the following conditions: +/-10% rated voltage at rated constant V/f ratio except for specific torque boost situations. Motors shall operate successfully under running conditions at rated load and V/f ratio when the voltage unbalance at the motor terminals does not exceed one percent.
B	Torques	Motors shall meet or exceed the minimum locked rotor (starting) and breakdown torques specified in NEMA Standard MG1 Part 12 for Design B for the rating specified when on sine wave power.
C	Operating speed range	- Zero to base speed in case of VT. - 1000: 1 for CT (with blower cooling) - 10:1 , 6:1 , 4:1 for CT .
D	Locked rotor (starting) currents	Shall not exceed NEMA Design B values for the specified rating on 5:1 constant torque or less and variable torque motors. NEMA Design A values are allowed for 6:1 constant torque or

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		higher value constant torque rated motors. Motors shall be capable of a 20 second stall at six times full load current without injurious heating to motor components.
E	Efficiency	- Shall have a nameplate minimum and nominal full load efficiency for motors when tested in accordance with NEMA standard MG1 Part 12, IEEE Test Procedure 112 Method B, using accuracy improvement by segregated loss determination including stray load loss measurements.
9.0	Motor location	Outdoor / indoor installation.
10.0	Painting	For indoor motors: - Surface preparation shall be made by sand blasting or shot blasting to near white metal - After surface preparation two coats of air drying epoxy based red oxide zinc phosphate primer shall be applied. Dry film thickness of each coat shall be 30 microns minimum. - After primer has dried two coats of air drying epoxy based enamel paint shall be applied. Dry film thickness of each coat shall be 40 microns minimum. - The total thickness of painting shall thus be 140 microns.

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		For outdoor motors: - Surface preparation shall be made by sand blasting or shot blasting to near white metal. - After surface preparation two coats of air drying epoxy based red oxide zinc phosphate primer shall be applied. Dry film thickness of each coat shall be 30 microns minimum. - One coat of air drying epoxy resin based intermediate paint shall be applied after primer. Dry film thickness of intermediate paint shall be 100 microns minimum. - After intermediate paint has dried two coats of air drying epoxy based enamel paint shall be applied. Dry film thickness of each coat shall be 40 microns minimum. The total thickness of painting shall thus be 240 microns.
11.0	Nameplate	- Shall be of stainless steel and stamped per NEMA Standard MG1 Part 10 and Part 31. - Nameplate information shall include as a minimum, the nominal efficiency value per NEMA Standard MG1 Part 12, the bearing identification numbers, power factor, Torque values with speed range and amps for that torque value. - Nameplate also shall include Full

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		Load Slip RPM, Magnetizing amps and (if included) encoder PPR and Voltage rating.

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SCHEDULE-7

STANDARD SPECIFICATION FOR UNINTERRUPTED POWER SUPPLY SYSTEM

1.1 GENERAL

Technical parameters for design

Power supply system	**:**	**440 V, 50 Hz, 3 phase, 4 wire**
System neutral	**:**	**Earthed**
Insulation level	**:**	**2.5 kV**
System short circuit level	**:**	**50 kA for 1 second**
Output Voltage	**:**	**240V, AC, 50 Hz.**

UPS system shall be of adequate capacity to cater for power requirement of the entire automation system.

This shall include PLC panels, I/O Panels, Workstations, etc., located in operator's room and various electrical rooms.

This shall also include power supply for I/O interrogation, transmitter power supply (24V DC) for field instruments connected to PLC wherever applicable, etc.

1.2 Basic particulars for design:

Basic details:

- **Features and performance in line with IEEE 446 and configuration as per fig 45 of IEEE 446.**
- **125% of the rated output for 15 minutes**
- **Suitable for connecting to a 415 V, 3 phase, 50 Hz, 4 wire, grounded neutral system with a symmetrical fault level of 50 kA rms.**
- **Three / Single phase voltage and frequency controlled output, as required.**
- **With isolating transformer, rectifier, inverter unit and necessary DC batteries.**
- **Dual redundant system with automatic static bypass and common DC battery.**

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- DC battery shall be sealed maintenance free Lead acid with plate cells type.
- Battery shall be suitable to maintain the power supply for at least 30 minutes in the event of mains failure.
- 25% overload condition to be considered for battery sizing.
- Electronic bypass switch to connect the system to the mains supply without interruption to the load in the event of inverter failure.
- Necessary distribution board in different areas for distribution of power from UPS output to individual consumers.

Permissible variations:
Mains power supply system

- Voltage : ± 10 %
- Frequency : ± 5%

Output of the uninterrupted power supply system while delivering a load of its rated capacity

- Voltage : (+/-) 3 %
- Frequency : (+/-) 0.1 %
- Harmonic distortion: Max. 2 %

Transformer

- Rating suitable for the application
- Dry type , with class H insulation
- + 2.5% with tappings on primary

Rectifier

- Dual rectifier with each unit rated for supplying both inverter load and battery charger load.
- Rectifier unit shall consist of minimum six pulse bridge connection
- With necessary smoothing reactor and filters
- Automatic boost and float charging control

Protective features:

- Maximum current limiting

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- Automatic reduction of current limit in the event of cooling fan failure
- Boost charging and float charging current limiting
- Earth fault monitoring and protection
- Thermal overload protection

Indications:

- Rectifier ON
- Battery run out timer/counter
- Low battery voltage or blown battery fuse
- High battery voltage
- Charging failure
- Failure in line voltage or auxiliary supply
- Blown fuse, single phasing or over current
- Fan failure
- Battery on float charge /boost charge.
- Inverter On
- Inverter reserve synchronised

Batteries:

Batteries for UPS shall be lead acid sealed maintenance free type. The Ampere Hour rating of the battery shall be adequate to supply the inverters on full load for 30 minutes back up. Batteries shall be installed in suitable metallic enclosure and located near UPS.

Inverter & Controls:

Construction details:

- Unitised construction
- Free standing, floor mounted and indoor type
- Provided with anti vibration Pads
- Dust and vermin proof
- Sheet steel clad , Min 2.0 mm thick for panels & : Min 1.6 mm thick for doors and side covers
- With illumination lamps, door switches, space heaters and sockets for soldering
- All control block plug-in type with test sockets
- Units shall be self contained and serviceable

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Basic Features:

- IGBT Based.
- With input circuit consisting of battery contactor, filter and smoothing reactor
- Dc/dc converter for voltage control
- Inverter proper and control electronics
- Series reactor and parallel filter
- Output transformer.
- Static by-pass
  - Switch load automatically to the reserve power supply on fault
  - Fast acting inverter contactor to connect the inverter output to the load.
  - High speed fuses
  - The changeover within 20 ms.

Indication

- Load on inverter
- Load on By-pass
- Reserve within limits

Meters

- Output voltage - Phase-neutral & between phases
- Output frequency
- Ammeter in each phase
- Battery current and voltage with indication of status in charge or discharge

Alarms

- Reserve out of limits
- Load on reserve
- Static switch off

Protection against the following:

- Abnormal output voltage
- Abnormal link voltage
- Over current on output
- Over current on input or commutating failure
- Low battery voltage
- High transformer temperature

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- **Auxiliary supply failure**
- **Fan failure**
- **Logic failure**
- **Clock failure**

1.3 Enclosure and ventilation

- **Enclosure conforming to IP-41 class**
- **Units shall be provided with cooling fans and louvers at the bottom sides.**
- **Individual ventilation ducts for each unit shall be provided.**

1.4 UPS DISTRIBUTION BOARD

Suitable UPS distribution board with sufficient feeders to supply individual PLC panels, I/O Panels, Workstations etc.

20% spare supply feeders shall be considered for future use.

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SCHEDULE-8

8.4 LIST OF RECOMMENDED SPARES FOR TWO YEARS OPERATION & MAINTENANCE

SL.NO.	EQUIPMENT	DESCRIPTION OF SPARE	QUANTITY INSTALLED	QUANTITY RECOMMENDED	REMARKS
	ELECTRICAL				
1	Contactor Coil			2 nos. for each rating	
2	Push Button			4 nos.	
3	Bulb for signal lamp			10 nos.	
4	Proximity switch			4 nos.	
5	Limit Switches			1 no. of each type	
6	AC incoming fuse for VVVF drive			1 set for each rating	
7	Control cards for VVVF drive			1 set	
8	Digital input module			1no.	
9	Digital output module			1no.	
10				1no.	

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NOTE:-

The above list is indicative. The Tenderer shall provide the complete list during BE/DE stage.

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