ENCLOSURE

Ref. Indent No.: C/6410/7/5396

SPECIFICATIONS

Thyristerised Digital Static Drive System with microprocessor based controls for Drive Motors (2x3.5 MW, 900V, 4000A, 500RPM) of OSBT.

1. PURPOSE :

These 2 nos. DC motors are connected in tandem and are used to drive steam turbine & turbo generator rotors through a gear box (with ratio of 1:9) for dynamic balancing in over speed balancing installation. The rotors are run from '0' speed to full speed/ over speed (3750RPM) with smooth speed variation through acceleration/ deceleration. Nos of balancing runs are required to be taken depending upon type of rotor.

2. SCOPE OF SUPPLY:

2.1 Total engineering, supply, installation, commissioning & prove out of Thyristerised Digital Static DC drive system of Siemens/ ABB make and of suitable capacity to give dc power and run two nos. DC motors (each 3.5 mw, 900 volts, 4000 amps, 500 rpm) and to accelerate / decelerate electrically. The DC drive motors are run independently or together in tandem as per the type of rotor. Details of drive configuration/ features requirements are given separately at ANNEXURE – 1.

2.2 Microprocessor based operator control touch panel (HMI) on the control desk along with latest control desk elements replicating the existing features in addition to the features available with the offered drive system and PLC.

2.3 Requisite Feed back sensors for drive controller to be included.

2.4 Transformers (Two nos. according to drive configuration) of suitable rating with protection on primary & secondary side along with required complete accessories/ switch gear. The bus-bars/ Cables for output connection to thyrister bridges is to be decided by the party and also to be included in scope of supply. (The Input supply of 11 kv, 3 phase, 50 Hz, 800 A continuous load shall be available after a 11 kv circuit breaker at installation site.)

2.5 Switchgear for offered drive system like line fuses, MCCBs, Contactors, Relays, Current relays, DC fuses, Chokes, Filters, Operator panel, control transformers, Power disconnections/ breakers.

2.6 Bus bars, along with its ducting & supports to interface drive system and DC motors. Prices to be quoted separately.

2.7 Cables for 11kv connection to transformers(Sl. No. 2.4) after 11kv point at installation site, cables for power connections, Signal cables, Control Cables, Panel wiring, Interfacing feed back & control elements, cables for requisite display and controls extension to control room and other wiring material like lugs, ferrules, cable/ wire markers, cable trays etc.

2.8 Earthing of supplied electrical equipment to be ensured to earthing point available at site. Earthing strips/ material to be included in scope of supply.

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2.9 Air conditioners of adequate rating for thyrister drive panel enclosure, PLC and ventilation for other panels as per requirement.

2.10 Modular mini PLC, Siemens/ ABB/ Fanuc make, with minimum 64 inputs & 32 outputs (digital & analog) to incorporate the complete logic and controls of the drive system, control desk & motor selection. Comprehensive range of modules for optimum adaptation to automation task, user friendly handling design, efficient processing speed for short machine cycle time, easily expandable, simple & interactive programming software, communication via MPI, PROFIBUS-DP & also through Ethernet. In built diagnostic features and display unit for display of operational parameters, faults, alarms of system.

3. SPARES:

Recommended spares for 2 yrs trouble free operations may be offered indicating item wise price & quantity to be quoted separately. This should include:

3.1 SITOR fuses, Thyristor for armature - 10 nos each type.
3.2 Thyristors & diode for field ckt. – 6 nos. each.
3.3 Control cards of drive – 1 no. of each type or 1 set.
3.4 PLC input & out put cards and CPU – 1 no. of each type.
3.5 Relays, contactors, MCCB, cooling fan - 1 no. each type.
3.6 Feed back devices (Encoder & Tacho) – 2 nos each.
3.7 One complete drive in spare.
3.8 Indicating lamps, push buttons, selector switches, potentiometers etc. – 5 nos each.

4. INSTALLATION :

Installation of panels, bus bar laying & termination connection, cable laying & termination connections, inter panel cabling & wiring, internal panel wiring and interfacing of new drive system (along with switchgear & accessories) with DC motors, transformers, control desk & PLC to be done by Vendor at BHEL's works in OSBT. Vendor has to provide following details in advance within two months after placement of purchase order and to be mutually agreed between Vendor & BHEL.

4.1 Required floor space for transformers, switch gear of transformers, drive cabinets and control panels along with lay out details.
4.2 Cable schedule & bus bar routing.
4.3 Details of foundation, cable trenches, cable racks and bus bar supports
4.4 Civil work drawings for equipment, cable trench, cable tray & bus bar supports etc.

If felt necessary, supplier will depute his expert for discussions & mutual agreement on above points.

Civil works & erection shall be done by BHEL.

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5. COMMISSIONING:

Vendor shall be totally responsible for commissioning the equipment at works. The vendor will ensure the operation/ testing, accuracy and safety with existing system & motors. The vendor shall arrange its own special tooling/ instruments required if any for commissioning.

6. PROVE OUT:

The vendor will test & prove the drive system on two rotors (medium wt & heavy wt) during balancing operation. BHEL will arrange the rotors for balancing.

7. TRAINING:

7.1 One week training of one engineer at drive manufacturer's works in field of maintenance free of cost.
7.2 The vendor's expert will impart on job training to BHEL engineers, free of cost, for operation & trouble shooting of drive system during prove out.

8. DOCUMENTATION:

Four sets of following documents to be supplied with equipment:

8.1 Descriptive operation & maintenance manuals with circuit diagrams/ PCB diagram details for all the items.
8.2 Electrical schematic diagram for all the items/ panels.
8.3 Wiring diagram/ cable layouts/ bus bar layouts.
8.4 Installation & user instructions for software if any.
8.5 Service & user manuals of all bought items.
8.6 PLC program print out & soft copy.

9. WARRANTY:

The vendor shall stand the warranty for the material supplied and work done for a period of 12 months from the date of successful commissioning/ prove out of equipment.

10. INSPECTION:

Pre-inspection like performance testing at Supplier's Works shall be done by BHEL prior to dispatch, for which supplier shall intimate BHEL 7 days in advance.

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11. GENERAL:

11.1 Drive System should be of latest state of art technology & compact design.
11.2 Complete technical details & product catalogues shall be furnished with offer for our technical scrutiny.
11.3 Vendors to furnish details of customers where similar drive of same rating (or near by rating) offered in past and is in operation.
11.4 If vendor desires, it may depute their technical expert(s) for on-site assessment, discussions, analysis & understanding of present set up/ system before submitting offer/ quotation with prior appointment with BHEL Hardwar.
11.5 All equipment/ measuring units shall be suitable for operation on power supply connection of 415V ±15%, 50±3%Hz, Three phase AC/ 230V ±10%, 50±3%Hz, Single phase AC.
11.6 All equipment/ measuring units shall be suitable for operation in Tropical humid dusty environmental conditions. Ambient Temperature: Max. 50ºc, Min. 0ºc, RH: up to 90% (non condensing). Max. temperature & RH not likely to occur simultaneously.
11.7 Offer should be in two parts bid i.e. techno commercial and price bid separately. Prices should be quoted in break up form. Installation, Commissioning and Software (if any) prices should be quoted separately.
11.8 The vendor should submit a compliance statement indicating compliance /non compliance against every point of enquiry in their technical bid.
11.9 All layout arrangements, connection schemes and wiring schemes shall be mutually agreed between vendor & BHEL.
11.9 The vendor will depute their experts for installation, commissioning, prove out and imparting training at BHEL Haridwar's works, indicating number of experts & the total time duration for completing above work within 7days of invitation from BHEL.
11.10 All electrical panels are to be provided with proper illumination and 220V, 5 A sockets and earthing.
11.11 LED type good quality signal-cum-PBs and signaling lamps to be used.
11.12 Apart from above given scope of supply, item/ parts felt necessary by vendor shall be specified and quoted.
11.13 Vendor should give details of their after sales service support along with the offer.

12. QUALIFYING CONDITIONS:

12.1 Only those venders, who have supplied, installed & commissioned at least one Thyristerised Digital Static Drive of same, near by or higher rating for DC motor control application, will qualify for bidding.

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12.2 Vendor will submit, along with offer, name of customer/ company where system at sl. No. 1 has been installed & commissioned by vendor.

12.3 Vendor will also furnish name & designation of contact persons of customer with contact phone no., fax no. and email address.

12.4 Vendor will submit, along with offer, certificate from customer regarding satisfactory performance of system supplied at sl. No. 1.

12.5 BHEL reserves the rights to verify information furnished by vendor. In case the information is found to be false/ incorrect, the vendor will be disqualified and his offer shall be rejected.

ANNEXURE – 1

1. DETAILS OF DRIVE CONFIGURATION & FEATURES REQUIREMENTS :

a) Double drive with flexibility of independent/ parallel operation to be offered for each motor i.e. overall 4 drives and each individual drive bridge should be rated for minimum 950V and 2200 amps dc continuous current. Drives to be supplied in cabinet units.
b) Drive should essentially to be offered in 12P configuration to limit the harmonics.
c) Drive should be suitable for 4 Quadrant operations and shall have dynamic overload capability.
d) Drive should be suitable & able to function in Indian Tropical weather conditions (see General point 11.6 of specification).
e) All power sections shall consist of latest generation Thyristor preferably of Siemens/ ABB make.
f) Field controller shall be integral part of drive system.
g) Tacho-generator and pulse encoder input should be integral part of drive & should have provisions to accept Zero marker input. The Tacho should be Huebner make & encoder should be Heidenhain/ Siemens/ ABB make.
h) Gating controller of drive should have synchronization in all 3 phases of power section.
i) Drive should have a dynamic response of 6-9 ms due to limitation of application criticality.

1.10 Each drive should have 2 serial interfaces on basic unit to allow direct inter-converter communication for higher speed control processes and simultaneous control of converters via PLC.

1.11 A PLC to be provided in panel/ control desk to give featured benefits like: flexibility in configuring scheme as per requirement of the application, to eliminate control logic using auxiliary contactors, to reduce the wiring in panel and easy programming without any external hardware. Five nos interlocks/ status signals to be incorporated from present system.

1.12 Galvanic isolation signal converters must be provided between drive & external circuit.

1.13 Drive shall be equipped with a hand held operator panel for display, loading, editing operational parameters and local control.

1.14 Degree of protection for panel should be to IP 21 and paint shade should be RAL 6011 (inside & out side)

1.15 Cable entries for power & auxiliary from bottom & routing of electronic & signal cables to be separated from power & control cables.

1.16 Equipments to be mounted on galvanized mounting plate 3mm thick.

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2. Digital DC drive must provide following minimum standard functions:

2.1 Fully controlled bridge for armature power section & half controller single phase bridge for Field section.
2.2 Drive software should have connectors, binectors, intervention points, motorized potentiometers, multi turn manual pots among others.
2.3 Selection of analog tachometer or pulse encoder should be possible by parameter settings without any modification in hardware to have complete flexibility for selection of speed sensor.
2.4 Analog tacho measurement time should be limited to app.1 ms for precise speed control.
2.5 Close loop function in armature to have both torque & current control with setting/ selection for torque/ current limiting.
2.6 Dynamic response of current controller should be maximum up to ~9 ms.
2.7 Self tuning i.e. measurement of motor resistance & speed loop optimization.
2.8 Selection of drive motor direction of rotation to clock wise/ anti clock wise. Provision to be incorporated in control desk.
2.9 Control stability of 0.006% of rated motor speed for pulse encoder operation & digital set point.
2.10 Automatic voltage adjustment for power range.
2.11 Flash EPROM on control board.
2.12 Four analog inputs: two ± 10 VDC and two 4 -20 mA in each drive.
2.13 Four analog out puts: two ± 10 VDC and two 4 -20 mA in each drive.
2.14 Four programmable binary inputs & four out puts.
2.15 Two separately addressable serial interface ports.
2.16 User digital interface panel with LED display. Stop, start, parameter, speed control and forward/ reverse.
2.17 Over 160 warning & fault messages for comprehensive protection and faults are to be shown on digital operator panel.
2.18 Control source like start, stop, forward, reverse, emergency stop, torque selection/ setting, current limit setting etc to be provided at i) control desk in control room. ii) PMU (keypad). iii) Terminal Block Inputs. Iv) Serial Ports. v) Operational key pad with parameter storage memory. vi) Commissioning software.
2.19 Adjustments: i) Controlled access authorization to the individual parameters ii) operating source (Local, Remote, Serial) iii) individual adjustment of torque and current limits iv) Parameterization via PC using drive software v) trace functions up to 8 measured quantities.

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3. Protections:

Following minimum protections must be provided:

3.1 Armature over voltage.
3.2 Armature over current.
3.3 Armature current ripple.
3.4 Loss of speed feed back/ speed measurement fault.
3.5 Tacho fault.
3.6 Motor over speed.
3.7 Minimum field current / Field failure.
3.8 Field over current.
3.9 Thyrister over temperature.
3.10 Auxiliary/ control supply over voltage/ under voltage/ failure.
3.11 Main supply (11kv) over voltage &under voltage. 11kv / 110v PTs are already installed on incoming feeder.
3.12 Inbuilt or additional protection in drive against mains power dip for the safety of drive component.

4. Standard displays:

Following minimum displays to be provided:

4.1 Line voltage mains (11 kv) to rectifier transformers at control panel and in control room CD. 11kv / 110v PTs are already installed on incoming feeder.
4.2 Line current to rectifier transformers (for three phase through selector switch) at control panel and in control room CD. 600/5A CTs are already installed on incoming feeder.
4.3 Frequency at control panel.
4.4 Selection of direction of rotation at control room CD.
4.5 Armature DC voltages for both motors at control room CD.
4.6 Armature DC currents for both motors at control room CD.
4.7 Field DC currents for both motors at control room CD.
4.8 Torque selection & set point at control room CD.
4.9 Status of binary inputs & out puts at control panel/ cabinet.
4.10 Thyrister temperature at control panel/ cabinet.
4.11 EMF set point at control panel/ cabinet.
4.12 Firing angle at control panel/ cabinet.

5. Software functions:

The basic software standard functions should be provided for maximum user friendliness regarding operator control and the highest degree of flexibility.