- Functional tests of control equipment, interlocks, inter-tripping, protection inputs, etc.
- Test of signal exchange with other systems (also with third parties – like LDC, etc.)
- Archiving system (capacity, consistency, redundancy, access times).
- Reports generation
- Emission analyser calibration and emission evaluation tests
- Calibration of metering system (accuracy shall be proven by certificates)

B0.7.3.4 Tests on Completion (Commissioning tests)

Preconditions of the Tests on Completion are:

- the successful completion of the individual erection checks of all items of the whole system;
- the issuing of the Final Erection Completion Certificate; and
- the successful completion of all pre-commissioning test.

Should the Employer decide that the preconditions for the Tests on Completion have not been adequately met, the Employer will advise the Contractor accordingly and withhold the commencement of the the Tests on Completion until the outstanding work is completed.

The Tests on Completion shall prove that the Plant is prepared and adjusted to ensure the correct functioning of the individual components and of the complete Plant.

The Tests on Completion shall cover at least following tests:

- Protection tests
  - Operation of selected turbine train protection devices including the following as a minimum:
    - fire protection
    - boiler protection
    - steam turbine protection
    - generator protection
    - transformer protection.

Method of alarm/ trip condition reset for subsequent starting.

- Operation of auxiliary systems:

Method of changeover of main equipment to stand-by equipment prior to Plant starting (see start-up tests) and during normal operation for fuel oil, coal handling, ash handling, oil lube and cooling systems

- Operation of fire protection systems.

- Isolation procedures
  - Method of isolation of plant equipment for safe shut-down and maintenance procedures including as a minimum:
    - HV station and unit supplies
    - LV supplies
    - fuel oil systems
    - coal handling systems
    - ash handling systems
    - fire protection systems.
- Protection systems/ settings, in accordance with agreed design and the requirements of the transmission system.
- Start-up tests
  - normal semi-automatic start to preset load
  - staged semi-automatic including start to synchronous speed, manual synchronizing (including synchro-check), automatic synchronizing, manual and automatic loading
  - starting with stand-by auxiliaries
  - operation of all auxiliaries.
- Verification of start-up times and loading rates of power unit and steam generator at various downtime conditions.
- Power unit(s)/Plant, to test partial and full load rejection to demonstrate
  - full load rejection tests to measure transient maximum speed and steady state speed at normal governor droop setting
  - method of resynchronism to be demonstrated steam turbine bypass operation capability.
- Power unit(s)/Plant, to verify and check
  - operating stability when operated between 30% and 100% nominal load conditions with load variations by increasing or decreasing the electric load
  - start-up/main fuel change-over:
    - semi-automatic change-over from fuel oil operation to coal operation
    - semi-automatic change-over from coal operation to fuel oil operation.
- Demonstration of the capabilities of the power unit to operate at rated voltage and frequency, at power factors and reactive conditions between 0.85 (lag) and 0.95 (lead).
- Start-up tests of the Plant equipment, facilities and systems including checking of automatic change-over of standby facilities as well as fuel.
- Verification of vibration guarantees.
- Environmental monitoring equipment, water quality monitoring equipment, functioning tests and verification of guarantees.
- Demonstration of the teledispatching and telemetering systems.
- Verification of Active Power Response and Voltage Control Response according to the requirements specified in the Network Connection Conditions.

- Demonstration of proper controlling, monitoring and recording according to the requirements of the Grid Code, including but not limited to the following tests:
  - Reactive Power
  - Fault Detection and Clearing Limits
  - Load Following Capability
  - Black Start (if applicable)
  - Voltage Following Capability (AVQC)
  - Excitation System and Power System Stabiliser
  - Primary, Secondary and High Frequency MW Response
  - Unit Start
  - Despatch Ramp Rate
  - Protection System
  - House Load Operation
  - Underfrequency Relay
  - Loss of AC Power Supply
  - Minimum Load
  - Site Test for Validation
  - Verification of completeness of scope of supply.

B0.7.3.4.1 Additional test in accordance with the PPA

Tests prior to synchronisation of each generating unit of the Plant
According to the requirements of the BPDB which are part of the PPA, the Contractor shall carry out the following additional tests prior to synchronisation of each generating unit of the Plant:

- automatic voltage regulator setting and adjusting in stand-still condition and with the generator running at no load
- turbine governor control checks, including a steam governor overspeed test (This test may be performed after a specified period of running of the Unit on load as per the manufacturer`s recommendation)
- open circuit and short circuit tests on the generator
- functional testing and timing of high voltage switchgear in the substation of the Facility
- The Company and BPDB shall verify that the protection level settings for switchyard protection equipment are as agreed by the Joint Coordinating Committee
- Voltage phasing checks will be carried out between the Grid System and the Facility; and

All inter-tripping circuits between the Plant and BPDB equipment shall be proved.

Tests for commissioning of each generating unit of the Plant
In addition to the above specified tests and according to the requirements of the BPDB which are part of the PPA, the following tests shall be carried out

by the Contractor for commissioning of each generating unit of the Plant after completing the tests set out before:

a. **Dependable Capacity Test**
Refer to Section **0.7.4.**

b. **Reliability Run**
Refer to Section **B.0.7.5**

c. **Automatic Voltage Regulator ("AVR") Droop Test**
The AVR will be demonstrated to control the steam turbine generator voltage over its entire set range.

d. **Steam Turbine Governor Operation Test**
The operation of the steam turbine speed governor will be demonstrated.

e. **Reactive Capacity Test**
This test will demonstrate the capability of the Plant to operate at rated voltage and frequency at power factors and under reactive conditions in accordance with the manufacturer's generator rating curves to be provided by the Contractor, insofar as these tests can be accommodated within the grid system.

f. **Minimum Load Capability Test**
This test will demonstrate the capability of each Unit to be operated at minimum stable load while the steam turbines, and auxiliaries remain in a stable and controlled condition, see also

B0.7.3.4.2 72h Full Load Continuous Test Run

After successful completion of the Tests on Completion and availability of the Commissioning Completion Certificate (CCC), signed by the Employer and the Contractor, the "Authorization to Start the 72 h Full Load Continuous Test" shall be signed.

No trip is admitted during these 72 h. Should the Plant or a Unit, as the case may be, not follow the requested load during the 72 h test, the test shall be restarted.

B0.7.4 Performance Tests

Performance Tests of the Unit(s)
After successful completion of the 72h Full Load Continuous Test Run and after relevant test protocols have been accepted by the Employer for the Unit(s) and Common Facilities, the Contractor shall be allowed to prepare the Unit(s) for the Performance Tests.

For the Unit(s) following guarantees given in the **Technical Schedule B0** shall be tested during the related Performance Test; this includes:

- Performance guarantees of the Unit(s)
- Operating guarantees
- Emission guarantees
- Guarantees of steam generator(s), steam turbine generator(s), flue gas treatment systems etc.

Performance Test of the Plant
After completion of the Performance Tests of the Unit(s), the guarantees of the Plant and the common facilities shall be tested in a separate Performance Test; this includes:

- Performance guarantees of the Plant
- Emission guarantees of the Plant
- Emission guarantees of the auxiliary boiler
- Noise guarantees
- Guarantees of the water and waste water treatment systems
- Effluent and water outfall guarantees.

Dependable Capacity Test according to the PPA
Dependable Capacity means- means at any given time the net amount of capacity at the tariff metering; either for the first generating unit or for the Plant, as the case may be, as determined by the most recent dependable capacity test which shall be comply with ASME standards and shall be carried out as part of the Reliability Run. The Dependable Capacity of the Plant is measured at the Delivery Point. It equals the average Export Power Output, corrected to Reference Site Conditions using correction factors, delivered during twelve continuous thirty (30) minute periods divided by six (6) hours.

Performance Tests shall be conducted in accordance with following standards:

• the Plant	ASME PTC 46
• steam generator	ASME PTC 4 (or equivalent ISO)
• steam turbine	ASME PTC 6 (or DIN 1943 or equivalent ISO)

- cooling tower ASME PTC 23
- FGD plant ASME PTC 40.

The curves required for the correction of the power output and specific heat rate to the site specified ambient conditions shall be listed in the technical schedules of the Plant performance and steam generator and steam turbine performance, and shall be submitted with the Tender. These curves shall be conclusive and no extra correction shall be given.

The margins required for instrument inaccuracies and for all other reasons shall be deemed to be included in the guarantee figures. The actual figures determined during performance tests shall hence be not corrected with any margins due to instrument inaccuracies prior to comparison with the guarantee figures.

Degradation and fouling during commissioning and other operation prior to Provisional Acceptance shall be deemed to be included in the guarantee figures. The actual figures determined during performance tests shall hence be not corrected for any degradation or fouling effect prior to comparison with the guarantee figures.

Degradation curves for the Plant and Unit(s) performance shall be submitted by the Contractor with bid. The curves shall show the equipment's degradation in power output and heat rate versus equivalent operating hours. The curves shall be applicable up to and including final major overhaul.

Test program

In due time prior to the tests a detailed procedure covering the testing to be undertaken and the methods to be employed shall be provided by the Contactor. The test procedure shall also detail areas of responsibility and the items that specifically require preparation and agreement before the tests can be carried out.

The test program shall cover the following documents but not be limited to:

- test procedure and standards (including proposed formulae / curves and standards)
- test schedule
- type of test
- manpower and deployment schedule of the Contractor for performing the tests forms of test records and report
- description of instrumentation to be used, including accuracy, and calibration test results
- method of data recording
- list of all auxiliary loads that will be operating during the tests. The list of auxiliary loads shall be provided with the test program and agreed in the Test Procedure.
- method and equations/correction curves used for adjustment of recorded data to the design conditions.

Test responsibility
All tests shall be prepared and conducted by the Contractor. The Plant shall be operated by Contractor`s operation personnel.

The Employer and/or an independent third party, awarded by the Employer.shall have the right to witness the tests.

Contractor's personnel appointed to carry out the tests shall be adequately skilled and experienced. Information on these personnel shall be provided to the Employer as part of the test program for review.

Test instrumentation
The Contractor shall supply and install all test instrumentation needed to conduct the tests. Temporary instrumentation installed for test purposes only and shall be retained at Site upon the satisfactory conclusion of all tests and shall be then removed.

All instruments to be used for the test shall be strictly dedicated calibrated measurement equipment. Each measuring instrument used shall be according to controlled and provided with a valid calibration certificate.

The calibration shall be carried out by an independent third party, which shall have appropriated quality standards and which shall be to be approved by the Employer, except for instruments which are calibrated and certified at a certified laboratory and holding the authorized traceability certificate.

Test Duration
The test shall begin after the Plant or a Unit including common facilities, as the case may be, has established stable operation, as judged by the Employer and/or an independent third party, awarded by the Employer.

The test duration shall be in accordance with the standards and codes.

One 60-minute test run shall be conducted for each guaranteed load point, during which the operating conditions shall remain within the defined plant stability criteria.

Test conditions
Performance tests shall be conducted at conditions close to the conditions of the Guarantees. Thereby the boiler and steam turbine cycle shall be adjusted to the conditions of the corresponding heat balance diagram.

Since the accuracy of the test results highly depend on the exact water-steam cycle arrangement respective cycle isolation is required to avoid any unknown cycle leakages. The valve position list has to be provided by the Contractor prior to the performance test. This cycle arrangement shall fully

remain during the whole testing period. Any changes of the performance conditions during the tests are not allowed.

Test evaluation
The Contractor shall submit for the acceptance of the Performance Test all detailed measurements, calculations and individual test results (such as, but not limited to turbine efficiency calculations, generator and transformer details, condenser performance, feedwater heaters and deaerator details, boiler efficiency calculations, pulverizing fineness and other results, air heater temperature traverses and leakage results, coal handling system performance, ash characteristics and ash handling systems performance, ESP and FGD performance and emissions, individual auxiliary power consumption figures, major consumers performance, noise and effluents etc.) and the corrections made based on the correction curves.

The Performance Test report shall be submitted by the Contractor. This report shall include, as a minimum, the following:

- description of the test procedures
- instrumentation details and calibrations (not older than six months)
- full process flow diagrams for fuel, air and flue gas and water and steam with indication of instrument position
- standards that were used
- test logs and summary (arithmetic average) of test readings used for performance calculations
- full set of correction curves
- calculations
- instrument calibration certificates
- list of all auxiliary loads that were operated during the tests
- performance tests results for the "As-run" condition and for the "Corrected as-run conditions"
- conclusions of performance tests: test passed or not.

B0.7.5 Reliability test run

After successful completion of all Performance Tests the Plant or a Unit including common facilities, as the case may be, shall start the 30 (thirty) days Reliability Test Run.

During the Reliability Test Run the Contractor shall demonstrate that the Plant or a Unit including common facilities, as the case may be, is fit for commercial operation.

During the specified periods, the Plant shall be operated continuously and in accordance with the prevailing power requirements of the Transmission System/BPDB or as required by the Employer.

During the Reliability Test Run the Employer's operation personnel shall operate the Plant under the full supervision and the responsibility of the Contractor's Personnel and according to the O&M manual as supplied by the Contractor.

For the successful completion of the Reliability Test Run, a maximum of 4 trippings of not more than combined outage of 24 hours are allowed, otherwise the Reliability Test Run will be considered as failed and a new Reliability Test Run will have to be executed until the test has been completed.

At the conclusion of the Reliability Test Run the Contractor shall request from the Employer the issuing of the Provisional Acceptance Certificate (PAC).

A list of minor pending items, which are at the judgment of the Employer do not jeopardize the trouble-free operation of the Plant or a Unit including common facilities, as the case may be, could be attached to that certificate. The envisaged completion date for each item shall be stated in it.

With the issuing of the PAC the Employer takes legal possession of the Plant or a Unit including common facilities, as the case may be, and the Warranty Period will begin.

During the Warranty Period the Contractor has to keep at site at least three Warranty Engineers at Site. Part of their duty shall be inter alia to complete in time the works for the minor punch items mentioned in the PAC. They shall issue, together with the Employer, special reports, should any damages occur to any equipment. Moreover they shall assist the Employer during the daily plant operation and issue additional operational instructions, if requested. They shall assist the Maintenance Superintendent in his work organization and spare part handling procedure.

At the successful conclusion of the Warranty Period, the Contractor shall request the Employer to issue the Final Acceptance Certificate (FAC).

Additional requirements as per the PPA The Facility shall operate continuously (without interruption) for

Seventy two (72) continuous hours at then demonstrated Dependable Capacity. For ninety six (96) hours the output shall be as requested by BPDB in accordance with the Dispatch provisions as outlined in the PPA.

B0.8 Abbreviations

(Please refer also to relevant Sections "**Standards and Codes**" **and "Units of measurement"**)

AASHTO	American Association of State Highway and Transportation Officials
AC	Alternating Current
AGC	Automatic Grid Control
ASC	Average Site Conditions
ATRS	Automatic Turbine Run-up System
ATT	Automatic Turbine Testing System
AVQR	Automatic Voltage and Reactive Power Control
AVT	All Volatile Treatment
BFP	Boiler Feedwater Pump
BMCR	Boiler Maximum Continuous Rating
BMS	Burner Management System
BOD	Biological Oxygen Demand
BOP	Balance of Plant
BOQ	Balance of Quantities
BPDB	Bangladesh Power Development Board
BPS	Boiler Protection System
CCR	Central Control Room
CCTV	Closed Circuit Television
CD	Chart Datum
CEMS	Continuous Emission Monitoring System
CHP	Coal Handling Plant
CO	Carbon Monoxide
COD	Commercial Operation Date
COD	Chemical Oxygen Demand
CT	Current Transformer
CW	Cooling Water
DAF	Dry Ash Free
DC	Direct Current
DCDB	DC Distribution Board
DCS	Distributed Control System
DDCMIS	Distributed Digital Control Monitoring & Information System
DCS	Distributed Control System
DOE	Department of the Environment, Bangladesh
DOSH	Department of Safety and Health, Bangladesh
DPC	Damp Proof Course
DWT	Dead Weight Tons
ECP	Electrochlorination Plant
EHG	Turbine Electro Hydraulic Governor Control System
EHSG - TTP	IFC Environmental Health and Safety Guidelines Thermal Power Plants

EHV	Extra High Voltage (500 kV)
EIA	Environmental Impact Assessment
EMC	Electro-Magnetic Compatibility
EPC	Engineering, Procurement, Construction
ESP	Electrostatic Precipitator
ETP	Effluent Treatment Plant
FDF	Forced Draught Fan
FEGT	Furnace Exit Gas Temperature
FGD	Flue Gas Desulphurization Plant
FTU	Field Mounted Termination Unit
GCV	Gross Calorific Value
G-EHSG	IFC General Environmental Health and Safety Guideline
GJ	Gigajoule
GPS	Global Positioning System
GRP	Glass Fiber Reinforced Piping
GWh	Gigawatt hour
GSO	Grid System Operator
HART	Highway Addressable Remote Transducer
HAZOP	Hazard and Operability Study
HCSD	High Concentration Slurry / Solids Disposal
HDPE	High Density Polyurethane
HHV	Higher Heating Value
HMI	Human Machine Interface
HRC	High Ruption Capacity Fuse
HV	High Voltage
HVAC	Heating, Ventilation, Air Conditioning
Hz	Hertz
I&C	Instrumentation and Control
IDF	Induced Draught Fan
IOD	Initial Operation Date
IP	Intermediate Pressure
IPL	Independent Protection Layer
IPP	Independent Power Producer
IR	Infrared
kV	Kilovolt
kW	Kilowatt
LAN	Local Area Network
LCC	Local Control Center
LCV	Lower Calorific Value
HSD	High Speed Diesel
LHV	Lower Heating Value
LIE	Local Instrument Enclosure
LIR	Local Instrument Rack
LP	Low Pressure
LV	Low Voltage
LVS	Large Video Screen
MCC	Motor Control Center
MCL	Maximum Continuous Load

MCR	Maximum Continuous Rating
MCWP	Main Cooling Water Pump
MDBFP	Motor Driven Boiler Feed Pump
MLSD	Land Survey Datum
MNCL	Minimum Continuous Load
MNCR	Minimum Continuous Rating
MOV	Motor Operated Valve
MV	Medium Voltage
MVA	Megavolt Ampere
MVAR	Megavolt Ampere Reactive
MWh	Megawatt hour
MWQCS	Marine Water Quality Criteria and Standards
NCC	Network Control Center
NDE	Non Destructive Examination
NFPA	National Fire Protection Association
NLDC	National Load Dispatch Centre
NO_x	Nitrogen Oxides
NOR	Notice of Readiness
NPSH	Net Positive Suction Head
NRV	Non Return Valve
O&M	Operation and Maintenance
OEM	Original Equipment Manufacturer
OHL	Over head line
P&I	Piping and Instrumentation
P&ID	Piping and Instrumentation Diagram
PA	Public Address
PABX	Private Automatic Branch Telephone Exchange
PA	Primary Air
PADO	Plant Performance Analysis, Diagnosis and Optimization System
PAF	Primary Air Fan
PC	Pulverized Coal
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
PF	Performance Fuel
PLC	Programmable Logic Controller
PPA	Power Purchase Agreement
PQR	Procedure Qualification Record
PSS	Power System Stabiliser
PVC	Polyvinyl Chloride
PWD	Public Works Department
PWHT	Post welding heat treatment
QA	Quality Assurance
RAPH	Regenerative Air Preheater
RC	Reinforced Concrete
RSC	Reference Site Conditions
SA	Secondary Air
SAH	Steam Air Heater

BIFPCL

INTERNATIONAL OPERATIONS DIVISION New Delhi-3

SCADA	Supervisory Control and Data Acquisition
SCAPH	Steam Coil Air Heater
SCS	Substation Control System
SER	Sequence of Events Recording
SG	Steam Generator
SI	Soil Investigation
SIL	Safety Integrity Level
SO_2	Sulphur Dioxide
SOE	Sequence of Events
SSC	Summer Site Conditions
ST	Steam Turbine
STG	Steam Turbine Generator
SWAS	Steam and water analyses system
TCS	Technical Comment Sheet
TDS	Total dissolved solids
TEFC	Totally enclosed Fan cooled
TG	Turbine Generator
TIG	Tungsten Inert Gas
TLA	Three-Letter Abbreviation
TMC	Turbine Maximum Capacity
TMCR	Turbine Maximum Continuous Rating
TSCS	Turbine Stress Control System
TSI	Turbine Supervisory Instruments
UHF	Ultra High Frequency
UV	Ultraviolet
VDU	Video Display Unit
VT	Voltage Transformer
VMS	Vibration monitoring system
VWO	Valves Wide Open
WSC	Winter Site Conditions
WPS	Welding procedure specification
WTP	Water Treatment Plant
WWD	Weather Working Days
WWTP	Waste Water Treatment Plant

B0.9 Technical Schedules

The following technical schedules comprise part of this specification. The data and requirements specified in the respective forms are to be adhered to and the missing data of forms are to be completely filled in. The completed technical schedules are to be submitted with the Bid.

B0 Technical Schedule General
B0 Sub-supplier List

SECTION IB
SPECIFIC TECHNICAL REQUIREMENT
ELECTRICAL SYSTEMS

BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED, BANGLADESH

2X660 MW MAITREE SUPER THERMAL POWER PROJECT

COLTCS/SCS/DF/TWS

TECHNICAL SPECIFICATION (ELECTRICAL PORTION)

CONTENTS

SECTION	TITLE	NO OF SHEETS
I	SPECIFIC TECHNICAL REQUIREMENTS	2
I	ELECTRICAL SCOPE BETWEEN BHEL & VENDOR	2
I	ELECTRICAL LOAD DATA	1
II	MOTOR DATASHEET-A	1
II	MOTOR DATASHEET-C	5
II	QUALITY PLAN FOR MOTOR BELOW 55 KW	2
II	QUALITY PLAN (FOR MOTORS 55 KW & ABOVE)	9
II	TYPICAL CABLE TRAY DETAILS	1

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".

b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.

c) Supply of mandatory spares as specified in the specifications of mechanical equipment's.

d) Electrical load requirement for COLTCS/SCS/DF/TWS.

e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned under part B0 of FICHTNER Technical Specification.

f) Various drawings, data sheet as per required format, quality plans, calculations, Type test & Routine test reports & certificates, operation and maintenance manuals, complete technical literature with catalogues etc. shall be furnished as specified at contract stage. All documents shall be subject to customer /BHEL approval without any commercial implications to BHEL.

g) All electrical equipment (Motors, cables, cabling material etc.) shall meet requirements of specification B0- "General Technical Specification".

h) All materials, components and equipment covered under this specification shall be procured, manufactured as per the requirements of specification B0- "General Technical Specification" For motors, BHEL standard quality plan for Motors (55KW & ABOVE) enclosed with the specification shall also be complied.

i) Acceptance of motor less than 30kW is based on COC of manufacturer & contractor confirming as follows:
It is hereby confirmed that the above mentioned motor/ motors was/ were manufactured taking care of BIFPCL specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting kVA/kW, temp. rise, distance between centre of stud & gland plate and tested in accordance with approved drawing/ data sheets.

j) Acceptance of motor rating between 30kW & 50kW is based on BIFPCL review of Routine Test reports as per relevant IEC by main contactor along with COC of manufacturer & contractor conforming as follows:
It is hereby confirmed that the above mentioned motor/ motors was/ were manufactured taking care of BIFPCL specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting kVA/kW, temp. rise, distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing/ data sheets.

k) The sub-vendor list for various electrical items is subject to BHEL/Customer approval without any commercial implications.
However, bidder to note that sub-vendor list attached with the specification is only indicative & shall be finalized with L1 bidder before placement of LOI.

l) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.

m) Cable BOQ worked out based on routing of cable listing provided by the vendor for "both end equipment in vendor's scope" shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: COLTCS/SCS/DF/TWS

SCOPE OF VENDOR: SUPPLY

PROJECT: 2X660 MW MAITREE SUPER THERMAL POWER PROJECT

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC Starter cum control panel (if applicable)	BHEL Vendor	BHEL BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	Vendor	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	 BHEL Vendor BHEL	 BHEL BHEL BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	BHEL	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	BHEL	Refer scope/ C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. FRP cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands and lugs for equipment supplied by Vendor	Vendor	BHEL	1. Cable glands shall be double compression Tinned brass conforming to BS: 6121. 2. Copper Cable lugs for control cable termination shall be PVC insulated/ sleeved type. The Material for lugs will be tinned copper only. Lugs for control cable shall be insulated & terminal shall be pin type/ flat type/ ring type / U type to suit terminal provided at panels.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	BHEL	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IEC: 61386-1.

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: COLTCS/SCS/DF/TWS

SCOPE OF VENDOR: SUPPLY

PROJECT: 2X660 MW MAITREE SUPER THERMAL POWER PROJECT

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
9	Lighting	BHEL	BHEL	
10	Equipment grounding & lightning protection	BHEL	BHEL	
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Equipment layout drawings	Vendor	-	For preparation of cabling layout drawings by BHEL, vendor shall furnish Electrical equipment layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling,
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

BHEL	**LOAD DATA (ELECTRICAL)**	JOB NO.		ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	2X660 MW MAITREE SUPER THERMAL POWER PROJECT	NAME		DATA FILLED UP ON
		SYSTEM / S	COLTCS/SCS/DF/TWS	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	ELECTRICAL	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

	TITLE	SPECIFICATION NO.
	LV MOTORS	VOLUME II B
		SECTION II
	DATA SHEET-A	REV NO. 00 DATE 27.11.2017
		SHEET 1 OF 1

1.0	Design ambient temperature	:	45 ºC
2.0	Maximum acceptable kW rating of LV motor	:	<160KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Degree of Protection	:	IP55
5.0	Type of Cooling	:	TEFC/CACA/TETV
6.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz (Variation: +4% TO –6%)
	c) Combined voltage & freq. variation	:	10%
	d) System fault level at rated voltage	:	50 kA for 1 sec
	e) Short time rating for terminal boxes		
	o 90kW & Above (Breaker controlled)	:	50 kA for 1 sec
	o Below 90kW (SFU/MCCB+: Contactor controlled)		50 kA for 0.20 sec.
	f) LV System grounding	:	Solidly
7.0	Class of insulation	:	Class ‘F’, with temp rise limited to class B.
8.0	Minimum voltage for starting (As percentage of rated voltage)	:	80% of rated voltage
9.0	Power cables data	:	Shall be given during detailed engg.
10.0	Earth Conductor Size & Material	:	Shall be given during detailed engg.
11.0	Space heater supply	:	240 V, 1Φ, 50 Hz
12.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW
13.0	Tests	:	As per motor spec. (enclosed)
14.0	Energy efficient/ Flame proof motor	:	Continuous duty LT motors up to 160 KW Output rating (At 45 deg.C ambient temperature), shall be Premium Efficiency class-IE3

- **For further detailing please refer specification B0- “General Technical Specification”**

MOTOR DATASHEET-C

CLAUSE NO.	Bidder's Name ……..

DE-	LT MOTORS	
A.	**GENERAL**	
1.	Manufacturer & Country of origin. (Shall be as per approved QA make)	
2.	Equipment driven by motor	
3.	Motor type	
4.	Quantity	
B.	**DESIGN AND PERFORMANCE DATA**	
1.	Frame size	
2.	Type of duty	
3.	Type of enclosure /Method of cooling/ Degree of	
4.	Applicable standard to which motor generally	
5.	Efficiency class as per IS	
6.	(a)Whether motor is flame proof	Yes/No
	(b)If yes, the gas group to which it conforms as per	
7.	Type of mounting	
8.	Direction of rotation as viewed from DE END	
9.	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
10.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
11.	Maximum continuous load demand of driven	
12.	Rated Voltage (volts)	
13.	Permissible variation of :	
	a. Voltage (Volts)	
	b. Frequency (Hz)	
	c. Combined voltage and frequency	
14.	Rated speed at rated voltage and	
15.	At rated Voltage and frequency:	
	a. Full load current	

CLAUSE NO.	Bidder's Name ……..

	b. No load current	
16.	Power Factor at	
	a. 100% load	
	b. NO load	
	c. Starting.	
17.	Efficiency at rated voltage and frequrecy,	
	a.100% load	
	b. 75% load	
	c. 50% load	
18.	Starting current (amps) at	
	a. 100 % voltage	
	b. 85% voltage	
	c. 80% voltage	
19.	Minimum permissible starting Voltage (Volts)	
20.	Starting time with minimum permissible voltage	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
21.	Safe stall time with 100% and 110% of rated	
	a. From hot condition	
	b. From cold condition	
22.	Torques :	
	a. Starting torque at min. permissible voltage(kg-	
	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg.m) available	
	e.Rated torque (kg.m)	
23.	Stator winding resistance per phase (ohms at 20	
24.	GD2 value of motors	

CLAUSE NO.	Bidder's Name ……..

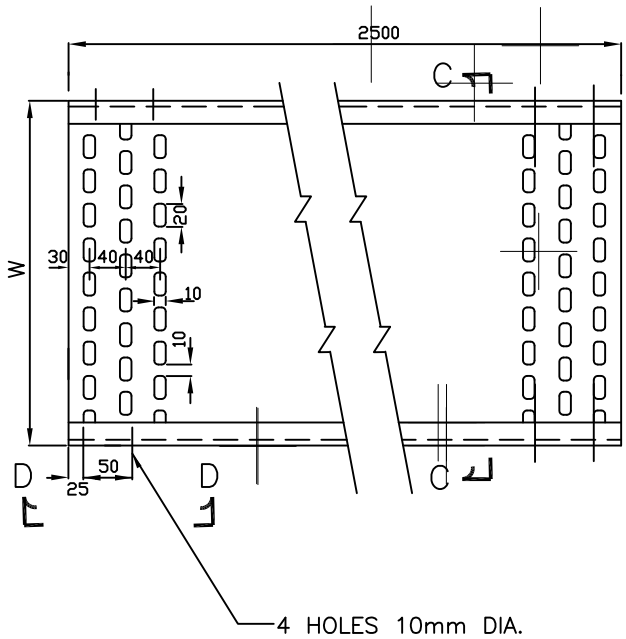
25.	No of permissible successive starts when motor is in hot condition	
26.	Locked Rotor KVA Input	
27.	Locked Rotor KVA/KW	
28.	Vibration limit :Velocity (mm/s)	
29.	Noise level limit (dBA)	
C.	**CONSTRUCTIONAL FEATURES**	
1.	Stator winding insulation	
	a. Class & Type	
	b. Winding Insulation Process	
	c. Tropicalised (Yes/No)	
	d. Temperature rise over specified maximum ambient temperature of 50 deg C	
	e. Method of temperature measurement	
	f. Stator winding connection	
2.	Main Terminal Box	
	a. Type	
	b. Location(viewed from NDE side)	
	c. Entry of cables(bottom/side)	
	d. Recommended cable size(To be matched with cable size envisaged by owner)	
	e. Fault level (MVA),Fault level duration(sec)	
	f. Cable glands & lugs details (shall be suitable for	
3.	Type of DE/NDE Bearing	
4.	Motor Paint shade	
5.	Weight of	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	

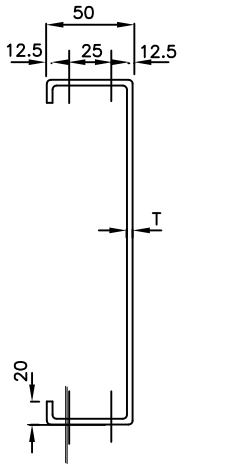
CLAUSE NO.	Bidder's Name ……..

D.	**List of accessories.**	
1.	Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)	
2.	Terminal Box for Space Heater (Yes/No)	
3.	Speed switch (Yes/No)	
4.	Insulation of bearing (Yes/No)	
5.	Noise reducer(Yes/No)	
6.	Grounding pads	
	i) No and size on motor body	
	ii) Nos on terminal Box	
7.	Vibration pads	
	i) Nos and size	
	ii) Location	
8.	Any other fitments	
E.	**List of curves.**	
1.	Torque speed characteristic of the motor	
2.	Thermal withstand characteristic	
3.	Starting. current Vs. Time	
4.	Starting. current Vs speed	
5.	P.F. and Effi. Vs Load	
F.	**Additional Data to be filled for each rating of DC Motor**	
1.	Rated armature voltage (Volt)	
2.	Rated field excitation (Amp)	
3.	Permissible % variation in voltage	
4.	Minimum Permissible Starting voltage (volt)	
5.	At rated voltage	
	i)Full load Armature current.(Amp)	

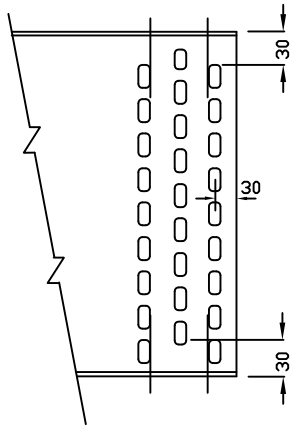
CLAUSE NO.	Bidder's Name ……..

	ii)Full load Field current (Amp)	
	iii)No load Armature current (Amp)	
6.	Full load Field current (Amp)	
7.	No load Aramature current (Amp)	
8.	Minimum permissible field current(Amp) to avoid	
	i) Maximum permissible voltage	
	ii) Rated voltage	
	iii) Minimum Permissible Voltage	
9.	Resistance (indicative Values) in ohm	
	i)Armature winding(Arm + IP + Series) at 25	
	ii) Field Winding at 25 deg. C	
10..	Inductance (indicative values)	
	i) Armature winding	
	ii) Field winding	
11	Value of trimmer resistance (ohm) to be connected in series with the shunt field to	
	i) 220 V DC	
	ii) 250 V DC	
	iii) 187 V DC	
12	Value of the external resistance (ohm)required to be connected in series with armature during starting only	
13	Technical data sheet for external resistance box	
14	GA drawing of motor	
15	Starting time calculation	
16	Starter resistance design calculation	
17	Electrical connection diagram of motor	

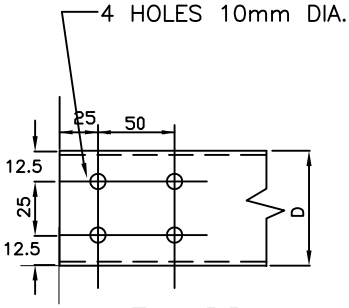




SECTION–CC
(100/50 TRAYS)



ARRANGEMENT OF
PERFORATIONS



VIEW–DD
(100,50W TRAYS)

TRAY WIDTH W (mm)	100	50
TRAY DEPTH D (mm)	50	50
T (mm)	2	2

PERFORATED TYPE TRAY

TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES	DWG. NO.

COMPREHENSIVE & UPDATED LIST OF MAIN VENDORS FOR BoIs PROCURED BY ELECTRICAL, C&I, MPL & MSE TO BE USED AS APPROVED SUB-VENDORS FOR BoP/ BoI PACKAGES						APPLICABLITY OF ITEM AS PER PACKAGE
S. No.	**Deptt.**	**Package**	**PMD Vendor/ Sub Vendor**	**Vendor Address**	**Remarks**	COLTCS/SCS/DF/TWS
1	Electrical	LV MOTORS (NON FLAME PROOF)	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	Sub vendor	YES
2	Electrical	LV MOTORS (NON FLAME PROOF)	BHARAT BIJLEE LTD.	BHARAT BIJLEE LIMITED, 1ST FLOOR, 7-B, RAJINDRA PARK, PUSA ROAD, NEW DELHI - 110 060.	Sub vendor	YES
3	Electrical	LV MOTORS (NON FLAME PROOF)	CROMPTON GREAVES	3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA	Sub vendor	YES
4	Electrical	LV MOTORS (NON FLAME PROOF)	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	Sub vendor	YES
5	Electrical	LV MOTORS (NON FLAME PROOF)	KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555 , MALLESWARAM WEST ,BANGALORE 560055	Sub vendor	YES
6	Electrical	LV MOTORS (NON FLAME PROOF)	LAXMI HYDRAULICS PVT. LTD	129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR-413003, MAHARASHTRA	Sub vendor	YES
7	Electrical	LV MOTORS (NON FLAME PROOF)	MARATHON	MARATHON ELECTRIC INDIA PRIVATE LTD.SECTOR - 11, MODEL TOWN, FARIDABAD - 121006	Sub vendor	YES
8	Electrical	LV MOTORS (NON FLAME PROOF)	NGEF	POCKET NO.10, FLAT NO. 37 & 38, EXPANDABLE DDA FLATS, NASIRPUR DWARKA, PHASE-I NEW DELHI-110 045	Sub vendor	YES
9	Electrical	LV MOTORS (NON FLAME PROOF)	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053	Sub vendor	YES
10	Electrical	LV MOTORS (NON FLAME PROOF)	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	Sub vendor	YES
11	Electrical	LV MOTORS (FLAME PROOF)	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053	Sub vendor	YES
12	Electrical	JUNCTION BOXES (NON FLAME PROOF)	JASPER ENGNIREES PVT. LTD.	A-23, SECTOR - 8, NOIDA-201301	Sub vendor	YES
13	Electrical	JUNCTION BOXES (NON FLAME PROOF)	Electro Controls & Devices	M/S ELECTRO CONTROLS & DEVICES, F-41, SITE-C, SURAJPUR INDUSTRIAL AREA GREATER NOIDA, UTTAR PRADESH :201308	Sub vendor	YES
14	Electrical	JUNCTION BOXES (NON FLAME PROOF)	M/s Shrenik & Co.	39A/3, PANCHRATNA INDUSTRIAL ESTATE, SARKHEJ-BAVLA ROAD, CHANGODAR, AHMEDABAD – 382 213	Sub vendor	YES
15	Electrical	JUNCTION BOXES (NON FLAME PROOF)	M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115	Sub vendor	YES
16	Electrical	JUNCTION BOXES (NON FLAME PROOF)	Adroit Control Engineers Pvt.Ltd.	M/S ADROIT CONTROL ENGINEERS PVT.LTD. PLOT-3, KRISHNA INDL. AREA, SECTOR-25 FARIDABAD – 121004	Sub vendor	YES
17	Electrical	JUNCTION BOXES (NON FLAME PROOF)	M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115	Sub vendor	YES

18	Electrical	JUNCTION BOXES (NON FLAME PROOF)	MIKA ENGINEERS	BRANCH OFFICE : 'D'-101, DHEERAJ HERITAGE RESIDENCY II, SHASTRI NAGAR, SANTACRUZ (W), MUMBAI 400 054.	Sub vendor	YES
19	Electrical	JUNCTION BOXES (NON FLAME PROOF)	M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115	Sub vendor	YES
20	Electrical	JUNCTION BOXES (NON FLAME PROOF)	BAJAJ ELECTRICALS	BAJAJ ELECTRICALS LTD. ENGINEERING & PROJECTS BU (NORTH) 3rd FLOOR, GULMOHARHOUSE, COMMUNITY CENTRE 161/B-4, GAUTAM NAGAR, YUSUF SARAI NEW DELHI – 110049	Sub vendor	YES
21	Electrical	JUNCTION BOXES (NON FLAME PROOF)	AJMERA INDUSTRIES & ENGG. WORKS	AJMERA INDL. AND ENGG. WORKS. AJMERA HOUSE, A-61 / KHAIRANE MIDC. , TTC INDL. AREA, NAVI MUMBAI – 400705.	Sub vendor	YES
22	Electrical	JUNCTION BOXES (NON FLAME PROOF)	S.B. ELECTRICAL ENGINEERING CORPORATION	03, SARDAR GRIHA BUILDING, LOHAR CHAWAL, MUMBAI-400002	Sub vendor	YES
23	Electrical	JUNCTION BOXES (FLAME PROOF)	SUDHIR SWITCHGEAR	305/6, APEEJAY HOUSE, 130, BOMBAY SAMACHAR MARG, MUMBAI - 400 023. INDIA	Sub vendor	YES
24	Electrical	FRP CABLE TRAYS & ACCESSORIES	EPP COMPOSITES PRIVATE LIMITED	Mr. Jayraj Shah Plot No. 2646, Kranti Gate Main Road, Rajkot Phone- 02827-287060 Pincode : 360021 Email : vaishalijoshi@epp.co.in	PMD	YES
25	Electrical	FRP CABLE TRAYS & ACCESSORIES	SUMIP COMPOSITES PVT.LTD.	Mr.Suhrud Shah/Mr.Pulin Shah 39-A Panch Ratna Industrial Estate Sarkhej-Bavla Road. Changodar Ahmedabad Phone- 0271-7610701 Pincode : 382213 Email : sales@sumip.com	PMD	YES
26	Electrical	FRP CABLE TRAYS & ACCESSORIES	ERCON COMPOSITES	Mr. Mukesh Maheshwari F-123, M.I.A., Phase-II, Basni, Jodhpur Phone- 0291-2744064 Pincode : 342005 Email : ercon@ercon-india.com	PMD	YES
27	Electrical	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	PREMIER POWER PRODUCTS (CAL) PVT. LTD.	Chatterjee International Centre, 33A, Jawaharlal Nehru Road, 6th Floor, Suit No. - 11A, Kolkata, Phone- 9331008739 Pincode : 700071 Email : pppdaga@airtelmail.in	PMD	YES
28	Electrical	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	INDUSTRIAL PERFORATION (I) PVT.LTD.	MR. A. K. SAHA 327, R.N.GUHA ROAD, DUM DUM KOLKATA Phone- 9830241788 Pincode : 700028 Email : ipipl@cal2.vsnl.net.in	PMD	YES
29	Electrical	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	MR. G.D. SINGHEE/MR. MAHESH SINGHEE 26, P.K. TAGORE STREET, MAIN BUILDING KOLKATA Phone- 9830177331 Pincode : 700006 Email : mahesh@ratans.com	PMD	YES
30	Electrical	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	INDMARK FORMTECH PVT. LTD.	Mr. Narendra R. Meher J Block, Plot No.-375, MIDC BHOSARI PUNE Phone- 020-27130546 Pincode : 411026 Email : indmarkformtech@vsnl.net	PMD	YES

31	Electrical	CABLE GLANDS	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA	Sub vendor	YES
32	Electrical	CABLE GLANDS	ARUP ENGG & FOUNDARY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	Sub vendor	YES
33	Electrical	CABLE GLANDS	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI-600018	Sub vendor	YES
34	Electrical	CABLE GLANDS	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063	Sub vendor	YES
35	Electrical	CABLE GLANDS	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	Sub vendor	YES
36	Electrical	CABLE GLANDS	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	Sub vendor	YES
37	Electrical	CABLE GLANDS	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001	Sub vendor	YES
38	Electrical	CABLE LUGS	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	Sub vendor	YES
39	Electrical	CABLE LUGS	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001	Sub vendor	YES
40	Electrical	GI CONDUITS	BIS APPROVED MAKE		Sub vendor	YES
Note: No. of rows to be increased/ decreased based on the no. of entries for a particular package.						

SECTION IC
SPECIFIC TECHNICAL REQUIREMENT
CONTROL & INSTRUMENTATION SYSTEMS

C&I SPECIFICATION

FOR

TRAVELLING WATER SCREEN (TWS)

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1.4 Instrumentation Check Lists

1.5 Applicable Codes & Standards

1.6 Drive Control Philosophy

1.7 Instrument Stub Details

1.8 Instrument installation diagram

1.9 Applicable Cable Types

CONTROL PHILOSOPHY FOR TWS

2x660 MW BIFPCL, MAITREE (JOB NO. 421)
TRAVELLING WATER SCREEN

1.00	**SYSTEM**	**TRAVELLING WATER SCREEN**	
2.00	**COMMON / PER UNIT**	COMMON	
3.00	**CONTROL SYSTEM**	Standalone DDCMIS (Intake Pumps)	
3.10	**PROCESSOR CONFIGURATION FOR PLC SYSTEM**	NA	
4.00	**LOCATION OF CONTROL SYSTEM**	Intake water Pump House Control Room	
4.10	**CONTROL SYSTEM SCOPE (BIDDER/ BHEL/ CUSTOMER)**	BHEL	
5.00	**HARDWIRED INTERFACE WITH DCS (Y/N)**	NA	
5.10	**PURPOSE OF HARDWIRED INTERFACE WITH DCS**		
5.11	***a) COMMAND FROM DCS (Y/N)***	NA	
5.12	***b) STATUS FEEDBACK TO DCS (Y/N)***	NA	
5.13	***c) GROUP FAULT ALARM TO DCS (Y/N)***	NA	
6.00	**SOFTLINK TO DCS (Y/N)**	NA	
6.10	**PURPOSE OF SOFTLINK TO DCS**		
6.11	***a) COMMAND INTERFACE WITH DCS (Y/N)***	NA	
6.12	***b) STATUS MONITORING IN DCS (Y/N)***	NA	
7.00	**PROTECTION CLASS FOR PLC / RIO PANEL**	NA	
8.00	**CONTROL FROM PB's ON LCP/OWS ON LCP**	CONTROL FROM PB's ON LCP	
9.00	**ANNUNCIATION ON LCP (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS**	YES BIDDER TO PROPOSE MIN NO OF ALARMS/INDICATIONS	
9.10	**MIMIC ON LCP (Y/N)**	N	
10.00	**CONTROL FROM DCS IN CCR (Y/N)**	Y	
11.00	**TYPE OF SOFTLINK (TP/OFC)**	NA	
11.10	**COMMUNICATION CABLE SCOPE (BIDDER/ PEM/ EDN/ CUSTOMER)**	NA	
11.20	**REDUNDANT CABLE (Y/N)**	NA	
11.30	**PROTOCOL**	NA	
12.00	**RIO / RPU (Y/N)**	NA	
13.00	**## NO. OF OWS / LAPTOP**	NA	

13.10	**SIZE OF OWS/ CRT OR LCD**	NA	
14.00	**NO. OF PRINTER**	NA	
14.10	**PRINTER SIZE AND TYPE**	NA	
15.00	**$$ POWER SUPPLY AVAILABLE FOR BALL MONITOR (24V DC / 110 V AC UPS / 230 V AC UPS)**	NA	
15.10	**&& POWER SUPPLY AVAILABLE FOR PLC PANEL (3PHASE, 415 V AC/ 1PHASE, 110 V UPS/ 1PHASE, 230 V UPS)**	415 V AC, 3 PHASE	
15.20	**REDUNDANT FEEDERS (R) / NON-REDUNDANT (NR) FEEDERS FOR POWER SUPPLY**	R	
15.30	**UPS BATTERY CONFIGURATION (1X100% / 2X100%)**	NA	
15.40	**BATTERY TYPE (LEAD ACID/ Ni-Cd)**	NA	
15.50	**BATTERY BACK-UP TIME (in minutes)**	NA	
16.00	**ACTUATOR WITH INTEGRAL STARTER (Y/N)**	Y	
17.00	**PG/ DPG/ PS/ DPS/ PT/ DPT/LT for TWS**	DPT=2 no. & DPG = 1 no(ACROSS EACH STRAINER) , ultrasonic LT (4 Nos.) for each screen and in addition other Instrument BOQ as finalised during detail engineering.	
18.00	**REMARKS**		
19.00	**PROJECT SPECIFIC INFO**		
	NOTES:		
1.00	**OPERATION THROUGH HARDWIRED PUSH BUTTON MOUNTED ON LOCAL CONTROL PANEL SHALL BE PROVIDED.**		
2.00	**BIDDER TO TERMINATE ALL INSTRUMENTATION AND CONTROL ELEMENTS IN JUNCTION BOXES FOR FURTHER CABLING TO DCS BY BHEL/CUSTOMER. BIDDER TO PROVIDE INPUT/OUTPUT LIST, DRIVES LIST, JUNCTION BOX SCHEDULE AND TERMINATION DETAILS, RECOMMENDED CONTROL LOGICS / WRITE-UP ETC. DURING DETAILED ENGINEERING**		
3.00	**ALL THE INSTRUMENTS ALONG WITH NECESSARY FITTINGS, ACCESSORIES AND VALVE MANIFOLD ETC., INSTRUMENT RACK & JUNCTION BOXES, ERECTION HARDWARE SHALL BE IN BIDDER SCOPE OF SUPPLY.**		
4.00	**INSTRUMENT RACK AND JUNCTION BOXES SHALL BE IN BIDDER'S SCOPE OF SUPPLY.**		
5.00	**BIDDER TO FURNISH ELECTRICAL LOAD DATA DURING DETAILED ENGINEERING.**		
6.00	**ALARM FACIA SHALL BE UNDER BIDDER'S SCOPE. NO. OF FACIA SHALL BE DECIDED DURING DETAILED ENGINEERING.**		
7.00	**THE SCOPE OF CABLE SHALL BE REFERRED IN ELECTRICAL SCOPE SPLIT SHEET IN ELECTRICAL PORTION OF THE SPECIFICATION.**		

CONTROL PHILOSOPHY for TWS

1 Travelling Band Screens, Spray wash/flushing pumps, spray wash valves, automatic self-cleaning strainers and other auxiliaries shall be controlled and operated from standalone DDCMIS of Intake pumps system located in intake pump house control room, supplied by the Purchaser.

2 Ultrasonic LT shall be provided by bidder at the Inlet & Outlet of TBS for differential Level measurement.

3 The following shall be provided in DDCMIS.

a) All interlocks and protections for Travelling Band Screens, spray wash pumps, automatic self cleaning strainers shall be realized in the DDCMIS.

SPECIFIC TECHNICAL REQUIREMENTS

Specific Technical Requirements (C&I):

1. The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire 'travelling water screen'. The requirements given are to be read in conjunction with detailed Technical specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre bid clarification. In absence of any pre bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial and time implication.

2. All the instruments/equipment/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.

3. All approval/Inspection are to be carried out by Owner or owner appointed agency only.

4. Bidder shall provide local panel for local start/ stop monitoring of auxilia ries and equipment as per requirement. The requirement shall be decid ed dering detailed engineering.
   All local panel shall be NEMA 4X with canopy.

5. DP instruments with min. Capillary length of 15m to be supplied in case of installation in pit.

6. Instruments shall be suitable for sea or saline water application. MOC of impulse tubing & impulse pipe shall be CPVC (3/8") Sch 80 or better, Industrial grade up to manifold. MOC of impulse tubing, fittings (from manifold to instrument) and manifold shall be super duplex SS.

7. Power Supply Requirement:
   415V, 3 phase AC power supply shall be provided by Customer for the local control panel. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement to be arranged/derived by bidder by providing suitable control transformer.

8. Number of pairs to be selected for Screen /Control cable (Size : 0.5 mm2):

9. F-Type: 2P/4P/8P/12P/24P
   a) G-Type: 4P/8P/12P

10. For codes & standards refer detailed specification. Indian & Chienese standards are not acceptable

11. All transmitters shall be smart type and shall have 4-20mA DC signal with superimposed digital communication (HART). Each Temperature element shall be complemented with temperature transmitters, compensating cable, JB/rack & other erection hardware. All transmitters shall be fitted with a local analog/digital indicator displaying appropriate physical units which may be read clearly from an easily accessible position.

12. Instruments must have separate tapping lines. Sharing of the same tapping pipe for redundant instruments or various different instruments is not acceptable.

13. Instruments & its accessories shall be complied with weather of the Coastal Area.

14. As a general rule, measuring points and measuring equipment for critical protection shall be separate from and not combined with measuring equipment for the automatic control equipment.

15. The instrumentation and control equipment shall have high electro-magnetic and radio frequency interference immunity and shall not be affected by portable radio transmitters operated in the vicinity of the equipment. Any limitations shall be stated.

16. All instruments shall be protected by cases. The cases shall have enclosure classification not less than IP 42 according to EN 60529 when mounted indoors in totally enclosed rooms with provision for limited ingress of dust, IP 54 else in an enclosed building and IP 55W for mounting outdoors.

17. Electronic instruments shall not be located close to hot lines, vessels or other hot equipment. Ambient temperatures exceeding 80 °C shall not result in calibration difficulties or rapid deterioration of electronic components.

18. All pneumatic operated regulating control valves (if any) shall be envisaged with smart positioner.

19. The junction boxes for termination of instruments /actuator limit switches/solenoid valve limit switches etc. are in bidder’s scope.

20. Power supply derived for Transmitters, contact interrogation, interposing relay and solenoid shall generally be ungrounded 24V D.C only. In all cases redundancy in power modules shall be considered.

21. Bidder to note that all the transmitters/instruments supplied by Bidder shall be rack mounted. The racks shall be preassembled and provided by Bidder. Also no instruments / analyzers & JBs/Racks should be protruding on the walkway.

22. Instrument installation and accessories required and same shall be in Bidder's scope and shall be subject to customer/BHEL approval during detailed engineering.

23. Bidder to provide erection hardware including junction boxes, canopies, structural steel as required.

24. Redundancy of sensors shall be provided by bidder as per following:
(i) Triple redundancy for all analog and binary inputs required for protection of system /drives.
(ii) For all other control functions & alarms dual redundancy of the sensors shall be provided by the bidder.

25. Bidder to perform tests of C&I items/instruments/systems as per quality plans/type test attached in the specification.

26. Each valve/instrument shall be fitted with a stainless steel or aluminum nameplate indicating the valve/instrument service and reference number in accordance with the approved equipment coding system.

27. The equipment shall be of modern, compact design incorporating the latest developments in proven technology. All instruments whether for local indication or remote transmission shall be of good quality and shall have an accuracy and repeatability appropriate to their duty.

28. Bidder shall provide Cable Schedule in BHEL excel format which shall be provided during detailed engineering. Also, Cable Interconnections for Complete System shall be in Bidders' scope. DCS side details for hardwired signals shall be furnished by BHEL during detailed engineering.

29. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of

any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with. In case of any contradiction most stringent clause/condition shall prevail.

30. Typical hardwired scheme is provided in section D. Same shall be used by bidder for deciding signal interface between Microprocessor panel & MCC/SWGR/DCS/ Solenoid valve/Actuator/Field instruments etc.

31. Generally equipment shall be supplied from one composite range of measurements and control equipment as marketed by a reputable manufacturer of international standing and shall have a minimum of three years operational use on similar projects.

32. Local representative of C&I related BOI supplier shall be available in India/Bangladesh.

33. The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with the **VGB guideline RDS-PP (Reference Designation System for Power Plants - KKS system)**.

34. Sea worthy packing capable of performing all necessary functions like prevention of damage to the contents, sufficient to support frequent handling and lengthy period of outdoor storage in adverse weather conditions are required.

35. Instrument installation and accessories required shall be in Bidder's scope. The requirement indicated in the 'Instrument Installation Diagram', enclosed elsewhere in this specification, is minimal. Vendor submitted 'Instrument Installation Diagram' shall be subject to customer approval during detail engineering without any commercial and time implication. For instruments for which Installation Diagram is not attached, vendor’s Installation Diagram for such items will also be subject to customer approval during detail engineering without any commercial and delivery implication.

36. Training as per **clause no: B0.3.7 of section-1A** to be provided shall be in vendor’s scope.

37. *All documents, including the installation and operation and maintenance manuals as well as the related software shall be in fluent, legible English. In addition, operation and maintenance manuals shall*

be translated into ***Bangla*** *and provided as paper copies and in electronic format.*

38. Drawings/Documents and data to be furnished after award of the contract shall be in line with MDL furnished elsewhere in the specification.

	PROJECT: MAITREE, 2X660 MW PACKAGE: TG PACKAGE CONTRACTOR: BHEL HARIDWAR CONTRACT NO.:	LIST OF ITEM SREQUIRING QUALITY PLAN AND SUB CONTRACTOR APPROVAL SUB SYSTEM: C & I	REFNO.:00 REV NO.:00 Date:14.12.2015

Sl No.	Item	LIST OFITEMS		Vendor/Manufacturer Name	Place	SC_APPL_S	Remarks
2.	Thermocouples	*		SiemensLimited	Gurgaon	DR	
3.	Fibre optic Gen End Winding VibrationMonitoring System	II		Vibro System INC	Canada	A	Refer Note 1
3.	Fibre optic Gen End Winding VibrationMonitoring System	II		MC-Monitoring SA	Switzerland	A	Refer Note 2
3.	Fibre optic Gen End Winding VibrationMonitoring System	*		SiemensLimited	Gurgaon	DR	
4.	Level Switch (Float/Displacer Type)	III		Chemtrols Samil	Mumbai	A	
4.	Level Switch (Float/Displacer Type)	III		Pune Techtrols	Pune	A	
4.	Level Switch (Float/Displacer Type)	III		Levcon Instruments	Kolkata	A	
4.	Level Switch (Float/Displacer Type)	III		SBEM	Pune	A	
4.	Level Switch (Float/Displacer Type)	III		SiemensLimited	Gurgaon	A	
4.	Level Switch (Float/Displacer Type)	III		DKInstruments	Kolkata	A	
4.	Level Switch (Float/Displacer Type)	III		V Automat&Instruments	NewDelhi	A	
4.	Level Switch (Float/Displacer Type)	III		Magnetrol Instruments	Belgium	A	
4.	Level Switch (Float/Displacer Type)	III		Endress& Hauser Instruments	Switzerland / Aurangabad	A	
4.	Level Switch (Float/Displacer Type)	*		Pratolina Instruments	Mumbai	DR	
5.	Pressure/Differential Pressure Gauge	III		Manometer India	Mumbai	A	
5.	Pressure/Differential Pressure Gauge	III		H Guru Instruments(South India)	Bangalore	A	

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Sl No.	Item	LIST OFITEMS		Vendor/Manufacturer Name	Place	SC_APP L_S	Remarks
5.	Pressure/Differential Pressure Gauge	III		H Guru Instruments	Muzaffarpur Risra	A	
5.	Pressure/Differential Pressure Gauge	III		FISCHER MESS & REGELTECHNIK	Germany	A	
5.	Pressure/Differential Pressure Gauge	III		Baumer Technologies	Vapi	A	
5.	Pressure/Differential Pressure Gauge	III		GluckIndia	Mumbai	A	
5.	Pressure/Differential Pressure Gauge	III		A N Instruments	Narendrapur	A	
5.	Pressure/Differential Pressure Gauge	III		Ashcroft	Gandhinagar	A	
5.	Pressure/Differential Pressure Gauge	III		Wika Instruments	Pune	A	
5.	Pressure/Differential Pressure Gauge	III		NSRT	Kolkata	A	
5.	Pressure/Differential Pressure Gauge	III		PTCI	Kolkata	A	
5.	Pressure/Differential Pressure Gauge	*		Siemens Limited	Gurgaon	DR	
5.	Pressure/Differential Pressure Gauge	III		Walchand nagar Industries	Attikolla, Dharwad	A	
5.	Pressure/Differential Pressure Gauge	*		New Scientific Repairs & Tradi	KOLKATA	DR	

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Sl No.	Item	LIST OFITEMS		Vendor/Manufacturer Name	Place	SC_APPL_S	Remarks
5.	Pressure/Differential Pressure Gauge	*		Forbes Marshall (Hyd) Pvt Ltd	IDA Nacharam, Medak	DR	
6.	Pressure/DP/Flow Transmitters	II		ABB Limited	Bangalore	A	2600 T series
6.	Pressure/DP/Flow Transmitters	II		Emerson Process Management	Pawane	A	
6.	Pressure/DP/Flow Transmitters	III		Fuji Electric System	Japan /China	A	
6.	Pressure / D P / Flow Transmitters	II		Laxsons Automation	Daman	A	M/s Smar Brazil Make
6.	Pressure/DP/Flow Transmitters	III		ABB Utility Automation	Germany	A	2600 T series
6.	Pressure/DP/Flow Transmitters	III		Yokogawa India	Bangalore	A	Make M/s Yokogawa, Japan
6.	Pressure/DP/Flow Transmitters	III		Siemens Limited	Thane	A	
6.	Pressure/DP/Flow Transmitters	*		Chino corporation India	Ghaziabad	DR	
7.	Instrumentation Cables	II		Paramount Communication	Khuskhera	A	For PVC, FRLS
7.	Instrumentation Cables	II		KEI industries	Bhiwadi	A	For PVC, FRLS
7.	Instrumentation Cables	II		Delton Cables	Faridabad	A	For PVC, FRLS
7.	Instrumentation Cables	II		Cords Cables	Bhiwadi	A	For PVC, FRLS
7.	Instrumentation Cables	II		Elkay Telelinks	New Delhi	A	For PVC, FRLS
7.	Instrumentation Cables	II		Universal Cables	Satna	A	For PVC, FRLS

	PROJECT: MAITREE, 2X660 MW PACKAGE: TG PACKAGE CONTRACTOR: BHEL HARIDWAR CONTRACT NO.:	LIST OF ITEM SREQUIRING QUALITY PLAN AND SUB CONTRACTOR APPROVAL SUB SYSTEM: C & I	REFNO.:00 REV NO.:00 Date:14.12.2015

Sl No.	Item	LIST OFITEMS		Vendor/Manufacturer Name	Place	SC_APPL_S	Remarks
7.	Instrumentation Cables	II		NICCO Corporation	Kolkata	A	For PVC, FRLS
7.	Instrumentation Cables	II		Thermo Cables Ltd.	Hyderabad	A	For PVC, FRLS
7.	Instrumentation Cables	*		Advance Cable Technologies	Bangalore	DR	
7.	Instrumentation Cables	*		Manoj Cables Limited	Delhi	DR	
7.	Instrumentation Cables	*		Pagoda Cables Pvt. Ltd.	Delhi	DR	
8.	Gas Analyser Cabinet	I		ABB Limited	Bangalore	A	H2 Analyser imported from ABB, Germany
8.	Gas Analyser Cabinet	I		Adage Automation	Mumbai	A	Hydrogen Gas Analyser (Calomat 6) will be Imported from Siemens Germany
8.	Gas Analyser Cabinet	I		Yokogawa India	Bangalore	A	Analyser will be imported from M/S Yokogawa Electric Corporation (YEC), Japan (Micro Processor based, Working on Gas Density Principle).
8.	Gas Analyser Cabinet	I		SiemensLimited	India	A	H2 Analyser imported from Siemens, Germany
9.	Conductivity Analyser (Conduction Measuring Equipment)	*		ForbesMarshall	Pune	DR	
9.	Conductivity Analyser (Conduction Measuring Equipment)	III		ABB India Limited	Bangalore/ Dehradun	A	Make:ABB,USA/UK

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Sl No.	Item	LIST OFITEMS		Vendor/Manufacturer Name	Place	SC_APPL_S	Remarks
11.	Pressure / DP Switch	*		BOLL & KIRCH	Germany	DR	
11.	Pressure / DP Switch	*		IMI Norgren Herion	India	DR	
11.	Pressure / DP Switch	*		Trafag Controls India Private	Gurgaon	DR	
12.	Capacitance type Level Transmitters/Switches	III		Magnetrol Instruments	Belgium	A	Application Capacitance Level Switches–Generator & Turbine Capacitance type Level Transmitters–Generator (Primary Water Tank)
12.	Capacitance type Level Transmitters/Switches	III		Endress+Hauser Instruments	Switzerland / Aurangabad	A	
12.	Capacitance type Level Transmitters/Switches	II		NIVO Controls	Indore	A	
12.	Capacitance type Level Transmitters/Switches	II		SBEM Pvt. Ltd.,	Pune	A	
12.	Capacitance type Level Transmitters/Switches	*		DK Instruments	Kolkata	DR	
13.	Guided Wave Radar Level Transmitters	III		Magnetrol Instruments	Belgium	A	Application-Main Oil Tank & Control Fluid Tank
13.	Guided Wave Radar Level Transmitters	III		Endress+Hauser Instruments	Switzerland / Aurangabad	A	Application- Main Oil Tank & Control Fluid Tank
14.	Position Transmitters	III		Siemens Limited	Gurgaon	A	Make-M/s Siemens, Germany
14.	Position Transmitters	III		ABB Limited	Bangalore/ Dehradun	A	Make-M/s ABB Germany
14.	Position Transmitters	III		Electronics Corporation	Hyderabad	DR	
14.	Position Transmitters	*		BI Enterprises	Mumbai	DR	

	PROJECT: MAITREE, 2X660 MW PACKAGE: TG PACKAGE CONTRACTOR: BHEL HARIDWAR CONTRACT NO.:	LIST OF ITEM SREQUIRING QUALITY PLAN AND SUB CONTRACTOR APPROVAL SUB SYSTEM: C & I	REFNO.:00 REV NO.:00 Date:14.12.2015

Sl No.	Item	LIST OFITEMS		Vendor/Manufacturer Name	Place	SC_APPL_S	Remarks
14.	Position Transmitters	*		Curtiss Wright Corporation	USA	DR	

LEGENDS :

DR–Detailed Required.
CAT- I:For those items the Quality Plans are approved by BIFPCL and final acceptance will be on physical inspection witness by BIFPCL.
CAT- II : For those items the Quality Plans are approved by BIFPCL. However no physical inspection shall be done by BIFPCL. The final acceptance by BIFPCL shall be on the basis of review of documents.
CAT- III : For those items Main supplier approves Quality Plans. The final acceptance by BIFPCL shall be on the basis of Certificate of Conformance by main supplier.
*- Inspection category will be decided during vendor evaluation.

Note 1: Wired Panel along with standard bought out items like Blank panel / enclosure, accessories like Ethernet switch, Power Supply, Terminal, MCB are accepted from indigenous suppliers acceptable to BIFPCL and tied up in QP.

Note 2:For items covered in Annexure-I to B0, Part-B, Section-V, Amendment No 5 of technical specification, BHEL has to furnish the details to establish qualifying / provenness requirement to BIFPCL for review at the time of detailed engineering irrespective of the approval category "A" or "DR" mentioned in the vendor list.

(BHEL-Hwr)

		PROJECT : Maitree STPP (2 x 660 MW)					LIST OF ITEMS REQUIRING QP				REF. NO :
		PACKAGE : EPC PACKAGE					APPROVAL & ACCEPTABLE				REVISION NO : 00
		CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN					VENDOR AS APPROVED BY				DATE : 12/12/2015
		CONTRACT NO :									
No.	Major Equipment	QP Inspection Category	QP No.	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
23	Temperature Transmitter	III				EMERSON	U.S.A/Pawane / Singapore	A			
		III				Yokogawa	Japan	A			Final testing at M/S YIL,Bangalore is also acceptable
		III				Moore	USA	A			
		III				M System	JAPAN	A			
		III				ABB	GERMANY/Faridabad	A			
		III				ENDRESS & HOUSER	Aurangabad	A			
		*				Khrone		DR			M/s BHEL will forward only two proposals after details review of BIFPCL Technical specification requirements.
		*				Tokyo Keiso	Japan	DR			
		*				INOR	Sweden	DR			
		*				P & F	India	DR			
		*				Siemens		DR			
		*				Yamatake	JAPAN	DR			
		*				Yamari	JAPAN	DR			
		*				Foxboro		DR			
25	Electronic transmitters (pressure, DP)	III				EMERSON (Rosemount)	USA/ Pawane	A			
		III				FUJI ELECTRIC	China	A			
		III				YOKOGAWA	JAPAN	A			Testing and Calibration at M/s YIL, Bangalore is also acceptable.
		I				ABB	FARIDABAD	A			Model - 2600 T
		III				ABB	GERMANY / Italy	A			Model - 2600 T
		III				Siemens	France / India	A			
		III				Honeywell	Pune	A			
		*				ENDRESS & HOUSER	Aurangabad/ Germany	DR			
26	Thermocouples, RTD & Thermowell	III				HERAUS SENSOR	GERMANY	A			
	Refer Note - 2	III				WISE Control	Korea	A			
		II				Tempsens	Udaipur	A			
		II				Pyroelectric	Goa	A			

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		PROJECT : Maitree STPP (2 x 660 MW)					LIST OF ITEMS REQUIRING QP			REF. NO :	
		PACKAGE : EPC PACKAGE					APPROVAL & ACCEPTABLE			REVISION NO : 00	
		CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN					VENDOR AS APPROVED BY			DATE : 12/12/2015	
		CONTRACT NO :									
No.	Major Equipment	QP Inspection Category	QP No.	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		II				Detriv Instrumentation & Electronics Ltd	Mumbai	A			
		III				Minco	USA	A			
		III				OKAZAKI corporation	JAPAN	A			
		III				Yamari	JAPAN	A			
		III				Yamari	Singapore	A			For RTD Reference list and Performance feedback is to be submitted
		III				ABB(SENSYCON)	Germany	A			
		III				EMERSON (Rosemount)	Germany	A			
		II				EMERSON (Rosemount)	Pawane	A			Imported from Emerson, Germany (make)
		II				Thermal Instruments(GIC)	Savantwadi	A			
		II				Techno Instruments	Ahamadabad	A			
		*				GOA Instrument Industries	GOA	DR			M/s BHEL will forward only two proposals after details review of BIFPCL Technical specification requirements.
		*				WIKA	Pune	DR			
		*				Toshniwal Industries	Ajmer	DR			
		*				E & H	Aurangabad	DR			
		*				Baumer	Vapi	DR			
27	Ultrasonic type level Transmitter	III				E & H	Aurangabad/ Germany	A			
		III				EMERSON	Pawane	A			
		III				SIEMENS MILTRONICS	CANADA	A			
		*				Wega	Germany	DR			M/s BHEL will forward only two proposals after details review of BIFPCL Technical specification requirements.
		*				Khrone	France / USA / Pune	DR			
		*				Yokogawa	Bangalore	DR			
		*				Honeywell	India	DR			
		*				Magnetrol	Belgium	DR			
		*				ABB	Germany	DR			
28	Orifice plate assembly	III				Instrumentation Limited	Palghat	A			
		III				Microprecision	Faridabad	A			
		III				Starmech	Pune	A			
		III				Flow Star	Faridabad	A			
		III				SEIKO	Austria	A			
		III				MINCO (GIC)	GOA	A			

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	PROJECT : Maitree STPP (2 x 660 MW)	LIST OF ITEMS REQUIRING QP	REF. NO :
	PACKAGE : EPC PACKAGE	APPROVAL & ACCEPTABLE	REVISION NO : 00
	CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN	VENDOR AS APPROVED BY	DATE : 12/12/2015
	CONTRACT NO :		

No.	Major Equipment	QP Inspection Category	QP No.	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		*				HBL Power Systems	India	DR			M/s BHEL will forward only two proposals after details review of BIFPCL Technical specification requirements.
		*				Dubas	India	DR			
		*				Chloride Power Systems (caldyne)	India	DR			
		*				Universal Instrument manufacturing co P Ltd	India	DR			
		*				Hind Rectifier Ltd	India	DR			
38	Battery Health Monitoring System	III				Emerson	Mumbai	A			
		III				Eltek SGS Pvt Ltd	Gurgaon	A			
		*				B Tech Inc	USA	DR			
		*				Hitachi Hi Rel	Gandhinagar	DR			
		*				Hopeckee	Germany	DR			
39	Battery(Ni-cd)	I				AMCO SAFT	Bangalore	A			
		II				SAFT	France/Sweede	A			
		I				HBL POWER	Hyderabad	A			
		*				Hopekee	Germany	DR			
40	Battery (Lead Acid Tubular / Plante)	I				Exide	Kolkata	A			
		I				HBL POWER	Hyderabad	DR			Only for tubular
		I				Hopekee	Germany	DR			
41	Impulse pipe & tubes	II				Mahrashtra Seamless	Raigarh	A			Carbon steel only
		II				Sumitomo/kawasaki/Nippon	Japan	A			
		II				TPS TECHNITUBE	Germany	A			
		II				Veluric & manessmann	Germany	A			
		II				BHEL	Trichy	A			
		II				Trouvay and Cauvin	France	A			Makes shall be as per apprvoed list (Sr. No. 41)
		II				ISMT	Ahamadnagar	A			Carbon steel only.
		II				Sandvik		A			For SS only.
		*				Jindal saw	India	DR			
		*				Ratanamani Metal and	Ahamadabad	DR			
		*				Shubhalaxmi Metal and	Mumbai	DR			
45	Local Instrument Enclosure/Rack	I				Pyrotech	Udaipur	A			
		I				Instrumentation Limited	Kota	A			

	PROJECT : Maitree STPP (2 x 660 MW)	LIST OF ITEMS REQUIRING QP	REF. NO :
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	CONTRACT NO :		

No.	Major Equipment	QP Inspection Category	QP No.	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		I				Sajas electrical	Trichurapalli	A			
		I				Prammen	Puddukottai	A			
		I				Chemin	Pondicherry	A			
		*				Forbes Marshall	Pune	DR			
		*				Procon	Chennai	DR			
46	Instrument Cables	II				Paramount	Khuskhera	A			PVC,FRLS type,RQP
		II				Polycab	Daman	A			PVC,FRLS type,RQP
		II				Delton	Faridabad	A			PVC,FRLS type,RQP
		II				KEI	Bhiwadi	A			PVC,FRLS type
		II				Elkey Telelinks	Faridabad	A			PVC,FRLS type
		II				CORDS	Bhiwadi	A			PVC,FRLS type,RQP
		II				CORDS	Kaharani	A			PVC,FRLS type,RQP
		II				Nicco	Kolkata	A			PVC,FRLS type
		II				TEW & C	USA	A			
		II				Habia cables	Sweeden	A			
		II				Kerpen cables	Germany	A			
		II				Lapp cables	Germany	A			
		II				Thermo elecrta Bv	Netherland	A			
		II				Universal Cable	Satna	A			PVC,FRLS type
		II				Thermocables	Hyderabad	A			
		II				Finolex Cable	Pune	DR *			
		II				Incab	Pune	DR *			
		*				Lapp cables	India	DR			M/s BHEL will forward only two proposals after details review of BIFPCL Technical specification requirements
		*				Lioni cable	Pune	DR			
		*				Gupta Cable	Orisa	DR			
		*				CMI	Faridabad	DR			
47	Electrical actuator	III				Auma	Germany	A			
		III				Limitorqe	USA	A			
		III				Rotorq	UK	A			
		II				Limitorque	Faridabad	A			
		II				Rotork	Chennai/ Bangalore	A			
		III				Nippon gear	Japan	A			
		II				Auma	Bangalore	A			
		III				Harold Beck	USA	A			
		III				Drehmo	Germany	A			

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		PROJECT : Maitree STPP (2 x 660 MW)					LIST OF ITEMS REQUIRING QP				REF. NO :
		PACKAGE : EPC PACKAGE					APPROVAL & ACCEPTABLE				REVISION NO : 00
		CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN					VENDOR AS APPROVED BY				DATE : 12/12/2015
		CONTRACT NO :									
No.	Major Equipment	QP Inspection Category	QP No.	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		*				Uniflex Cables	India	DR			
51	Pneumatic Actuator (Power Cylinder e. g. FOR	II				Dong Woo Valve Control Co. LTD	Korea	A			
		II				Shin Hwa Engineering Co. LTD	Korea	A			
		I				Instrumentation Limited	Palghat	A			
		I				Kelton		A			
		I				SMC Pneumatics	Noida	A			Up to 12 inch only
		I				Rotex	Mumbai	A			Conditional
		*				Festo	Bangalore	DR			
53	Transducer	II				AE	Mumbai	A			
		II				Southern Transducer	Chennai	A			
		II				Elster	Mumbai	A			
		III				Camilie Bauer	Germany	A			
		III				Metrawat	Germany	A			
		II				Rishab	Nasik	A			
		*				Pyrotech	Udaipur	DR			
59	Coupling / Interposing relays	III				PARAMOUNT	BANGALORE	A			* To be covered in DDCMIS QP
		III				OMRON		A			
		III				OEN		A			
		III				Jyoti	Baroda	A			
		III				ELSTA	SWITZERLAN	A			
		*				Schneider	Germany	DR			
		*				Siemens	Germany	DR			
		*				Phoenix	Germany	DR			
60	Solenoid valve	III				Rotex	Vadodara	A			
		III				Avcon	Mumabi	A			
		III				Herion	Germany	A			
		III				IMI NORGEN	GERMANY	A			
		III				Jafferson	Argentina	A			
		III				Asco	Chennai/USA	A			
		III				Festo	Bangalore	A			
		III				SMC	Noida	A			
		III				Parker	Brand Name	A			
		*				Schneider	Germany				

		PROJECT : Maitree STPP (2 x 660 MW)					LIST OF ITEMS REQUIRING QP			REF. NO :	
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		CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN					VENDOR AS APPROVED BY			DATE : 12/12/2015	
		CONTRACT NO :									
No.	Major Equipment	QP Inspection Category	QP No.	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		*				Neucon Industries Pvt. Ltd.		DR			
61	Lube oil control valve - Self Regulating	II				NUOVO PIGNONE	ITALY	A			
		II				EMERSON	CHENNAI	A			
		II				SAMSON	GERMANY / PUNE	A			
		II				Forbes Arca	Pune	A			Approved up to 4", 150 Class.
62	Guided waveRadar type level transmitter	III				Magnetrol	Belgium	A			
		III				Endress & Houser	Germany/ Aurangabad	A			
		III				Emerson	Sweden/ PAWANE	A			
		III				ABB(K-Tech)	USA	A			
		*				Yokogawa	Japan	DR			
		*				Khrone	France	DR			
		*				HONEYWELL		DR			
		*				Siemens	India	DR			
63	Maintenance and Calibration Equpiment					Main Contractor will propose the vendors during detail Engineering.					
65	Furniture for computer	III				OTS office tech.	India	NOTE			
		III				Godrej boyce		NOTE			
		III				Fetherlite		NOTE			
		III				PAN Office		NOTE			
		III				Pyrotech		NOTE			
66	Terminal Block (Cage and Clamp type)	III				Weidmuller	Germany	A			
		III				Phoenix	Germany /	A			
		III				Wago	Germany /	A			
		III				Elmex	Vadodara	A			CE Mark only

	PROJECT : Maitree STPP (2 x 660 MW)					LIST OF ITEMS REQUIRING QP				REF. NO :
	PACKAGE : EPC PACKAGE					APPROVAL & ACCEPTABLE				REVISION NO : 00
	CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN					VENDOR AS APPROVED BY				DATE : 12/12/2015
	CONTRACT NO :									

No.	Major Equipment	QP Inspection Category	QP No.	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		I				Cosmos	Noida	A			
		I				Adarsh Control	Bangalore	A			
		*				Chemin Controls	Pondichery	DR			
		*				Harmoney Systems	New Delhi	DR			
83	Digital Indicators	III				Masibus	Gandhi Nagar	A			For Non mosaic mounting
		III				ABB	Germany	A			
		III				Foxboro	UK	A			
		III				Yokogawa	Japan	A			
		III				Gossen / Metrowatt / Camille Bauer	Germany	A			
		III				Siemens	Germany	A			
		III				Chino	Japan	A			
		III				Weigell Messgerate	Germany	A			
		III				Pyrotech	Udaipur	A			For Non mosaic mounting
		*				Chino Corporation	Mumbai	DR			For Non mosaic mounting and submit only two proposals
		*				Yokogawa	Bangalore	DR			
		*				Lektrotek	Pune	DR			
		*				Teletherm	Chennai	DR			
84	Dust Emision Monitor	III				Land Combustion	UK	A			
		III				Durag	Germany	A			
		III				Sick Maihak	Germany	A			
		III				Emerson Process Management	Ireland	A			
		III				Codel	UK	A			
		II				Forbes Marshall	Pune	A			Main Kit from M/s Codel, UK
85	Electrical Indicating Instruments (Mosaic Compatible)	III				Siemens	Germany	A			
		III				Gossen / Metrowatt / Camille Bauer	Germany	A			
		III				Ganz	Germany	A			
		III				Weigell Messgerate	Germany	A			
86	Flue Gas Analyser (CO)	III				Codel	UK	A			
		III				Emerson Process Management	Pawane	A			Analyser from M/s Emerson, Germany / USA.
		III				Land Combustion	UK	A			

SUB-VENDOR LIST FOR **C&I**
2X660 MW MAITREE STPP- BANGLADESH

Sl No	Package Code	Package Name	Supplier Name	Tech Limit
1	145-04000-A	CONTROL VALVE	FORBES MARSHALL ARCA PVT.LTD.	No technical limit exists except for feed control valve. For feed control valves, approved up to sub-critical power plants of 600 MW rating.
2	145-04000-A	CONTROL VALVE	INSTRUMENTATION LTD.	
3	145-04000-A	CONTROL VALVE	Koso India Private Limited,	
4	145-04000-A	CONTROL VALVE	BOMAFA SPECIAL VALVE SOLUTIONS PVT LTD	
5	145-04000-A	CONTROL VALVE	KSB MIL CONTROLS LTD.	
6	145-04000-A	CONTROL VALVE	SUZHOU DELAN ENERGY SCIENCE & TECHNOLOGY CO., LTD.	
7	145-04000-A	CONTROL VALVE	WALDEMAR PRUSS ARMATURENFABRIK GMBH	
8	145-04000-A	CONTROL VALVE	Mascot Valves Pvt. Ltd.	
9	145-04000-A	CONTROL VALVE	R.K.CONTROL INSTRUMENTS PVT. LTD.	For subcritical power plant up to 150MW
10	145-04000-A	CONTROL VALVE	Valvitalia S.P.A. ,	
11	145-04000-A	CONTROL VALVE	PARCOL S.p.A	
12	145-04000-A	CONTROL VALVE	EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	
13	145-04000-A	CONTROL VALVE	DRESSER VALVE INDIA PVT. LTD	
14	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	
15	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	
16	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	
17	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	
18	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	
19	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	
20	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	
21	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	
22	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	
23	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	
24	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	
25	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	
26	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	
27	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	
28	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	
29	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	