12. SCOPE OF THE GOODS

12.1 General

The supplier shall supply all the Goods under this Contract.

12.2 Distributed Control System

(1) DCS System Cabinets

Four (4) sets of DCS system cabinet(s) to mount all components

(2) Plant Data Highway

4,000 meters length of a redundant pair of coaxial or twinaxial cable for plant data highway.

(3) Maintenance Tool

Two (2) sets of maintenance tool with 21" monitor and color printer for boiler control system

12.3 Man-Machine-Interface (MMI) System

(1) Man-Machine-Interface (MMI) computing units

Four (4) sets of two (2) boiler MMI computing units for four (4) boilers

(2) Displays

Four (4) sets of two (2) 21" monitors and one (1) 50" VDU for four (4) boilers

(3) Printers

Four (4) sets of one (1) color printer and one (1) dot printer for four (4) boilers

(4) MMI maintenance tool

One (1) set of one (1) MMI maintenance tool computing unit, one (1) 21" monitor with keyboard and mouse, one(1) dot printer and one(1) color printer

12.4 Plant Simulator System

(1) DCS System Cabinets

One (1) set of DCS system cabinet(s) to mount all components

(2) Man-Machine-Interface (MMI) Computing Unit

One (1) set of MMI computing unit for plant simulator

(3) Displays

One (1) set of two (2) 21" monitor and one (1) 50" VDT for plant simulator

(4) Printers for MMI

One (1) set of color printer and dot printer for plant simulator

(5) Control desk

One (1) set of control desk with anchor bolts for plant simulator

(6) Instrument Panel

One (1) set of instrument panel with anchor bolts for plant simulator

(7) Instructor's Desk

One (1) set of instructor's desk for plant simulator

(8) Maintenance Tool

One (1) set of instructor/maintenance tool with 21" monitor and color printer for plant simulator

12.5 Uninterruptible Power Supply System

Four (4) sets of uninterruptible power supply system (UPS) with storage battery for four (4) boilers.

12.6 Control Desks and Panels

12.6.1 Control Desks

Four (4) sets of control desks with anchor bolts for four (4) boilers

12.6.2 Instrument Panels

Four (4) sets of instrument panels with anchor bolts for four (4) boilers

12.7 Control Drives

(1) Followings are a list of the existing control drives. Control drives indicated put in parentheses are used for the existing mill systems and these shall not be used in the new system. Therefore total number of twenty (22) control drives for four (4) boilers shall be replaced to the new ones.

Quantity	*Service*	*Torque*	*Strocke time*	*Motor*
		(N-m)	(sec)	(w)
1	FDF inlet vane	1,600	63	750
1	IDF static blade	10,000	63	1500
1	GRF inlet gas damper for No.5, No.6 Boiler	1,600	63	760
2	GRF inlet gas damper for No.7, No.8 Boiler	1,600	63	180
2	Hot gas tempering	250	25	180
2	(PGF inlet damper)	1,600	63	63
2	(PC line purge)	250	63	25
2	(PC line warm-up)	250	63	63
2	(Mill inlet shut-off)	250	63	25
2	(Mill draft)	250	63	25

The supplier shall supply with:

Power supply contactors

Connecting linkage with crevice pins

Anchor bolts

Local switch box

(2) Total number of eight (8) control drives shall be supplied for the direct firing systems for four (4) boilers.

No. of Set	Service
4	Pulverizer inlet gas damper
4	Pulverizer temperature control damper

The supplier shall supply with:

Power supply contactors
Connecting linkage with crevice pins
Anchor bolts
Local switch boxes

12.8 Control Valves

(1) Control Valves

Total number of twenty (20) control valves shall be supplied for four (4) boilers as follows:

- Main feed water control valve x 4
- Primary spray control valve×8
- Secondary spray control valve×8

The supplier shall supply with:

Power supply contactors
Actuating motor
Special cable from contactor to actuating motor
Anchor bolts
Local switch boxes

(2) Power Supply Switchgears (Contactors)

Existing control valves have already replaced to the new ones on the rehabilitation project of the Phase-I. Power Supply Switchgears (Contactors) have not replaced with new contactless type. Total number of sixteen (16) power supply contactors for following control valves shall be supplied for four (4) boilers.

- Start-up feed water control valve x 4
- Auxiliary feed water control valve x 4
- Start-up spray control valve × 8

The supplier shall supply with:

Special cable from contactor to actuating motor

Local switch boxes

12.9 Instruments for Burner Management System

Instruments for burner management system shall be supplied as followings:

- eight (8) - Heavy oil shut-off valves, 4 for supply and 4 four return line.
  - Connecting pipe size : 57 mmOD x 3 mmt
  - Heavy oil condition : 30 kg/cm^2 x 115°C

  A pair of the supply and return shut-off valves shall be operated (tripped) simultaneously and its control switches shall be installed on the control desks.
- eight (8) - Heavy oil burner inlet valves.
  - Connecting pipe size : 20 mmID
  - Heavy oil condition : 30 kg/cm^2 x 115°C
- eight (8) - Purge steam stop valves.
  - Connecting pipe size : 20 mmID
  - Steam condition : 12 kg/cm^2 x 200°C
- four (4) - Heavy oil pressure transmitters
  - Heavy oil condition : 30 kg/cm^2 x 115°C
- four (4) - Heavy oil temperature thermocouples with thermo-wells
  - Pipe for measuring : 57 mmOD x 3mmt
  - Heavy Oil condition : 30 kg/cm^2 x 115°C

12.10 Transmitters

(1) Valves

Following valves shall be supplied for each transmitter for measuring fluid as follows (except direct mounted diaphragm type).

Service of Transmitter	*Stop Valve*	*Equalizing 3-valves*
Pressure	3	-
Differential pressure	4	1

One (two for diff. press.) stop valve(s) shall be utilized for root valve at tapping point and others are for transmitter shut-off and/or drain. Arrangement of equalizing valve for diff, press. measurements shall be of three valves.

(2) Transmitters to be replaced

Table TS-2-04 shows the specification of existing transmitters for control and TS-2-05 shows the specification of the existing transmitters for indication and record. Transmitters indicated in tables are used for the existing boiler systems and these shall not be used in the new system. The Supplier shall replace these transmitters to be selected adequate measuring points and list up in The Technical Schedule.

(3) Transmitters for direct firing system

The Supplier shall supply transmitters for modulating control to be selected adequate measuring points and list up in The Technical Schedule. The other transmitters, if necessary, for local control and instrumentation shall be supplied by the Supplier of Package-1. Primary elements such as a flow orifice or nozzle shall be supplied by the Supplier of Package-1.

Further details for the supply limits of both suppliers shall be referred to attached drawing MON-K-0-14 and typical instrumentation for the direct firing system shall be referred to attached MON-K-2-08.

Table TS-2-04 Transmitters for Control *for reference*

No.	*Service Name*	*Purpose*	*Measuring Condition*	*ΔP for flow measurement*
1	Main steam flow	Control	140k/560°C. 420t/h	2.5 kg/cm^2
2.	Feed water flow	Control	180k/230°C. 420t/h	1.6 kg/cm^2
3.	Drum level	Control	180k/230°C. ±150 mm	
4.	Drum pressure	Control	180k/356°C	
5.	MS header press.	Control	140k/540°C	
6.	Air flow	Control	Ambient. 190×10^{3}m^3/h	100 kg/m^2
7.	Furnace pressure	Control	-20mmAq	
8.	Continuous blow flow	Control	140k/356°C	

Table TS-2-05 Transmitters for Indication and Record *for reference*

No.	*Service Name*	*Purpose*	*Measuring Condition*	*ΔP for flow measurement*
1	Main steam flow	Record	139k/560°Cm 420 t/h	2.5 kg/cm^2
2.	Feed water flow	Record	210 k/230°C, 470 t/h	0.63 kg/cm^2
3.	1ry spray flow (L)	Indicate	155 k/340°C. 6.2 t/h	400 kg/cm^2
4.	1ry spray flow (R)	Indicate	155 k/340°C. 6.2 t/h	400 kg/cm^2
5.	2ry spray flow (L)	Indicate	155 k/340°C. 2.5 t/h	400 kg/cm^2
6.	2ry spray flow (R)	Indicate	155 k/340°C. 2/5 t/h	400 kg/cm^2
7.	Continuous blow (L)	Indicate	155 k/340°C. 4.5 t/h	1,600 kg/m^2
8.	Continuous blow (R)	Indicate	155 k/340°C. 4.5 t/h	1,600 kg/m^2
9.	Air flow	Indicate	Ambient, 190×10^{3}m^3/h	100 kg/m^2
10.	Pulv. coal flow (L)	Indicate	25 mmAq.	
11.	Pulv. coal flow (R)	Indicate	25 mmAq.	
12.	Furnace draft (L)	Indicate	25 mmAq.	
13.	Furnace draft (L)	Indicate	25 mmAq.	
14.	Main steam press.	Record	139k/560°C	
15.	Drum press.	Indicate	155k/360°C	
16.	Drum level	Record	155k/360°C. ± 150 mm	
17.	Drum level	Indicate	155k/360°C. ± 150 mm	
18.	Drum level	Indicate	155k/360°C. ± 150 mm	
19.	A-P.G.F out. Press.	Indicate	630 mmAq.	
20.	B-P.G.F out. Press.	Indicate	630 mmAq.	
21.	A-Mill ΔP	Indicate		760 kg/m^2
22.	B-Mill ΔP	Indicate		760 kg/m^2
23.	A-Mill inlet press	Indicate	40 kg/m^2	
24.	B-Mill inlet press	Indicate	40 kg/m^2	
25.	A-P.G.F. inlet press.	Indicate	1,000 kg/m^2	
26.	B-P.G.F. inlet press.	Indicate	1,000 kg/m^2	

12.11 Thermocouples and Thermo-Resistances

(1) Thermocouples and Thermo-Resistances should be replaced

Table TS-2-06 shows the numbers and length of measuring elements now being used in the power plant. Thermocouples and Thermo-Resistances indicated put in parentheses is used for the existing mill systems and these shall not be used in the new system. The Supplier shall select by himself adequate measuring points and list up them in The Technical Schedule.

These tables are only for reference. There exist other temperature measuring elements now in operation, which may be selected as best by the Supplier.

(a) Table TS-2-06 shows for one boiler unit.

(b) "No." and "Instrument No." shall be referred to Dwg.No.MON-K-2-13.

(c) Thermocouples and thermo-Resistances indicated put in parentheses are used for the existing mill systems and these shall not be used in the new system.

(d) Instruments with *mark are measured for boiler metal temperature for total 96 points. This number of points shall be changed to 48 points after rehabilitation. (See attached drawing MON-K-2-11 "Metal temperature diagram for drum & superheater".)

(2) Thermocouples and Thermo-Resistances for Direct Firing System

The Supplier shall supply thermocouples and thermo-resistances for P.C. pipes, primary gas.

The Supplier of Package-1 shall supply thermocouples and thermo-resistances for motor bearing, motor winding, oil lubrication system.

The Supplier of Package-1 shall provide thermo-wells with bosses or connecting flanges for all the above temperature elements.

Further details for the supply limits of both suppliers shall be referred to attached drawing MON-K-0-14 and typical instrumentation for the direct firing system shall be referred to attached MON-K-2-08.

Table TS-2-06 Temp. Measuring Points and Their Thermo-Elements Length

No.	Inst. No.			Measuring Item	Thermo-element length (mm)
3	K-n	27	R	(Mill (A) outlet P.C.)	500
4	K-n	3	R	S.H.O. steam	160
7	K-n	26	R	(Mill (B) outlet P.C.)	500
8	K-n	33	R	I.D.F. Motor bearing x 2	500
				F.D.F. Motor bearing x 2	
9	K-n	31	R	(Mill bearing x 4)	200
				(Mill gear box x 4)	120
				(Mill motor bearing x 4)	500
10	K-n	30	R	I.D.F bearing x 4	160
				IF.D.F. bearing x 2	160
				G.R.F. bearing x 2	160
				(P.G.F bearing x 4)	160
17	K-n	2	I	S.H.O Steam temp.	160
18	K-n	1	I	S.H.O. Steam temp.	160
33	K-n	6	I	1ry S.H. inlet header x 2	160
				Start-up spray inlet hdr x 2	160
				Start-up spray outlet hdr x 2	160
				1ry spray inlet hdr x 2	160
				1ry spray outlet hdr x 2	160
				2ry spray inlet hdr x 2	160
				2ry spray outlet hdr x 2	160
				3rd S.H. inlet hdr x 2	160
				S.H.O. hdr x 2	160
34	K-n	12*	I	S.H. elements metal	22meters in total *5 meters of MISS(*Mineral Insulated stainless steel sheathed with welding pad at tip*) and *17 meters of HRWR(*Heat resistant insulated stranded wire armored extension wire*)
35	K-n	10*	I	1ry S.H.O. hdr x 2	
				2ry S.H.O. hdr	
				3rd S.H.O hdr x 2	
36	K-n	11*	I	Start-up spray point out x 2	
				1ry spray point out x 2	
				2ry spray point out x 2	
37	K-n	5*	I	S.H. link pipe x 14	
40	K-n	23	I	Econ. outlet gas x 2	1250
41	K-n	24	I	(P.C. fuel pipe x 12)	14
				(P.C. bin x 8)	2000
42	K-n	28	I	(Mill outlet P.C. temp. x 2)	500
				A.H. inlet gas x 2	1250
43	K-n	25	I	(Mill inlet gas x 2)	500
				A.H. inlet gas x 4	1250
46	K-n	45a	I	(Mill outlet P.C. temp (A))	500
47	K-n	45b	I	(Mill outlet P.C. temp (B))	500

12.12 Furnace Brightness detector

Eight (8) sets of the furnace brightness detector shall be supplied for four (4) boilers.

12.13 Steam and Water Sampling System

12.13.1 Boiler Sampling Racks

Four (4) sets of boiler sampling racks with anchor bolts shall be supplied for four (4) boilers.

12.13.2 Analyzing Instruments

(1) Conductivity Transmitters

Twelve (12) sets of conductivity transmitters shall be supplied for four (4) boilers.

(2) pH Transmitters

Eight (8) sets of pH transmitters shall be supplied for four (4) boilers.

(3) Silica Analyzers

Eight (8) sets of Silica analyzers shall be supplied for four (4) boilers.

(4) Hydrazine Analyzers

Four (4) sets of Hydrazine analyzers shall be supplied for four (4) boilers.

12.13.3 Sampling Piping

One (1) lot of stainless steel piping suitable for steam and water sampling for boiler sampling racks, including fittings shall be supplied in length of 10,000 m total and with approx. 14 mm O.D.X1.5 mmt. The length shall be confirmed at contract stage.

12.13.4 Spot Cooler for Sampling Rack Cabin

Two (2) sets of spot cooler with suction filters and power switches (for 380 VAC) for purge of dust from the cabin and for keep lower ambient temperature in the cabin shall be included in the scope of supply.

12.14 Flue Gas Oxygen Analyzer

Eight (8) sets of the Flue gas oxygen analyzer shall be supplied for four (4) boilers.

12.15 Cables

(1) Cables should be supplied

The supplier shall supply all cables required between all hardware, panels, cubicles and desks provided under this Contract.

Supplier shall supply all control and signal cables, including the all cable conduit and tray.

The Supplier shall be requested to submit the detail design of the cable work including rationalization of field devices, allocation of signals and choice of marshaling termination for the field devices.

Only for reference, average cable length from boiler site to the CCR was as follows:

	No.5 B	No.6 B	No.7 B	No.8 B
for transmitter	210 m	240 m	260 m	280 m
for temp. element	280 m	300 m	320 m	340 m
for control drive	260 m	290 m	330 m	360 m

(2) Cables for Direct Firing System

The scope of supply for Cables for Direct Firing System is clarified in the attached Dwg.No.MON-K-0-14 "Supply limit for instruments and cables around the pulverizer".

The Supplier of Package-1 shall supply the Power cables for electric motors.

The both Suppliers of Package-1 and Package-2 shall, at Contract stage, coordinate each Scope of Supply as to terminal points of the cables and cable trays to avoid any shortage.

Followings shall be included in the scope of the Supplier.

- Four (4) sets of identification sheath (tube) printers
  (Letters include preferably Cyrillic alphabet)
- Six (6) dozens of market pens for vinyl and metal surface use
- Eight (8) sets of compression tools for terminal lug.

12.16 Terminal Panels and Terminal Boxes

Sufficient number of terminal panels shall be supplied as relay terminals from local to the CCR for four (4) boiler units.

Local terminal boxes for transmitters and temperature measurements also shall be supplied as necessary.

12.17 Spare Parts

Following Spare parts shall be supplied.

(1) One (1) set of 21" SXGA monitor.

(2) Thirties (30) pcs of lamp for 50" VDU display.

(3) One (1) set of dot printer.

(4) Two (2) sets of CD-R drive and hard disc unit.

(5) One (1) set of QWERTY keyboard.

(6) Two (2) sets of 150 mm vertical indicators, one (1) set for drum level and one (1) set for furnace brightness

(7) Five (5) % of each kind of transmitters, at least one.

(8) Five (5) % of each kind of thermocouples and thermo-resistances, at least one.

(9) Ten (10) % of power relays and buffer relays.

(10) Ten (10) pcs of each kind of fuses.

(11) One (1) set of gas O2 sampling proves.

(12) One (1) set of gas O2 sampling analyzer.

(13) Each two (2) sets of cells or electrodes for conductivity and pH transmitters.

(14) Sampling pump, reagent pump, and/or magnet valve, photo cell, lamp for chemical analyzers for three years use.

(15) Reagent and chemicals of chemical analyzers for three years use.

(16) Each four (4) sets of gland packing and bonnet gasket for each control valves.

(17) Eight (8) position transmitters for control valve actuators.

(18) Eight (8) thyrister units for control valve actuator.

(19) Eight (8) position transmitters for control drives.

(20) Eight (8) thyrister units for control drive.

(21) 3,000 sheets of copy papers

(22) Ink cassettes of color printer for 3 years use.

(23) Ribbon cassettes of dot printer for 3 years use.

(24) Message sheets of dot printer for 3 years use.

(25) 100 pieces of Floppy disk.

(26) 100 pieces of CD-R disk.

(27) 4 sets of DCS Controller

12.18 Test and Inspection

12.18.1 Visual Inspection before Designing

The Supplier shall perform the visual inspection at the Site to clarify the all needed area for his designing such as foundation, installation space, panel layout, interface to the existing equipment and the CCR. The Suppler shall inform his result of the inspection to the Purchaser. Further the Purchaser will cooperate for the performing of this inspection.

12.18.2 Test and Inspection at Workshop

Test and inspection shall include, at least items specified in code/standard and the following but not limited to.

Items and procedures shall subject to the approval of the Purchaser before the start.

(1) General

(a) Defective work discovered during inspection shall be remedied free of the charge by the Supplier under the terms of the guarantee of the contract. The costs of inspection of any defective item shall also be borne by the Supplier.

(b) Supplier shall submit the shop test schedules and procedures, at least two (2) months ahead of the test date for Purchaser's approval.

(c) The shop test will be witnessed by the Purchaser or his nominated representative.

(d) The Supplier shall prepare adequate records of the test and shall supply a minimum of seven (7) copies of such records to the Purchaser.

(2) Workshop Test

(a) Appearance Check

After completion of fabrication, all temporary fittings welded on shall be removed and finished to sufficiently and the surfaces shall be checked before painting to be free from any surface defects, flaw, spatters, burrs, scales, rust and so on.

Painted surfaces shall be free from excessive runs, sags, voids, over spray, blistering, peeling, mudcrack and rust.

(b) Shop Assembly

Shop assembly shall be performed by the Supplier to assure proper fitting of the various parts and for checking the correctness of clearance and dimensions. Parts thus assembled shall be match-marked for re-assembly at the Site, prior to being dismantled for shipment.

(c) Performance Test at the Workshop

For the DCS Cabinets, MMI (Man-machine-interface) system, Plant simulator, Performance Test shall be carried out at the workshop.

(3) Witness Inspection at the Factory

The Purchaser has the right to witness the tests of materials and element at the manufacturer's factory without additional coast. The Supplier shall provide all necessary assistance for these visits, inspections and checks and give all the information requested.

All expenses related to the tests shall be borne by the Supplier and shall include travel expenses, lodging and per diems etc. for the personnel of the Purchaser. (Refer to SectionIII, Clause 7.7)

Expenses needed for these Purchasers's personnel related the following witness tests shall be included in his Bids.

(a) DCS cabinets, MMI (Man-machine-interface) system, Plant simulator : Two (2) engineers, one time

- dimensional inspection
- operation check
- performance test

13. COMMISSIONING

13.1 General

Upon completion of the erection work of the Goods by an erection Contractor the Supplies shall commence Commissioning of the Goods.

Commissioning includes adjustment, performance, no-load and load test and test. The details are specified hereunder, but not limited to.

- The Supplier shall prepare all necessities for commissioning.

If incorrect erection work is found during the Commissioning period, modification work shall be done by the erection Contractor upon a notice of the Supplier through the Purchaser.

13.2 Commissioning

(1) The Supplier shall submit to the Purchaser the Commissioning procedures including time schedules one(1) month prior to start of the Commissioning. The procedures shall include adjustment and test procedures, evaluation criteria of adjusted and tested machines, instruments, control apparatus, sysytems etc.and forms of records.

(2) Commissioning is divided into the following stages.

(a) Initial Operation

This stage includes the operation of individual items of equipment for the first time, after all pre-energizing checks including sequence checking and testing of the electrical and control system are completed, to determine if the erection work is satisfactory and will function as required without damage.

(b) Loop Test/Individual System

Following the satisfactory initial operation of individual sections of equipment, certain items will be integrated into the complete individual system.

(c) Integrated System

When the loop test of each system is completed satisfactory, each system will be integrated into the complete plant system.

Initial boiler test firing, initial steam admission tests are included in this stage.

(3) Detailed contents of Commissioning shall be as follows, but not limited to :

(a) Wiring continuity tests

(b) Alignment of equipment

(c) Calibration of C&I equipment

(d) Checking and testing electrical relays, pressure swiches and instrument transmitters

(e) Setting protective devices and electrical protection relays

(f) H.V.test for relevant equipment

(g) Initial Operation

(h) Loop Test

(i) Damper Adjustment

(j) System Sequential OperationTrial

(k) Control System Adjustment and Setting or Tuning

(l) Interlock Test

(m) Operation Test

13.3 Completion of Commissioning

The Supplier shall give a notice of completion of the Commissioning. Upon the notice of the completion of the Commissioning if the Purchaser duty judges that the Commissioning is fully completed and the specified performances of the Goods are proved well the Purchaser shall give a certificate of completion of commissioning.

14. TRIAL RUN

Upon completion the commissioning the Supplier shall start the Trial Run under support of the Purchaser.

The Trial Run is a demonstrative operation of the Goods under the stable operation of the boiler with an output of 420 t/h.

The Trial Run shall be continued for not less than five (5) days.

After satisfactory completion of the Trial Run for each Unit, the Purchaser shall issue a Provisional Acceptance Certificate to the Purchaser.

When all the Works completed (it should be the date of Provisional Acceptance for the final unit), the Supplier shall remove from the Site all temporary facilities and the office provided by the Supplier.

15. SUPERVISION SERVICES

15.1 General

(1) The Supplier shall provide qualified and competent supervisors for the erection work of the Goods.
The erection work of the Goods will be carried out by an erection Contractor under the control and direction of the Purchaser.

(2) The Supplier shall propose the dispatching schedule of the supervisors, that includes period, man-month and duties of each supervisor and/or skilled worker, in the Technical Schedule.

(3) The Supplier shall supply the instructions for election work as specified in Clause 5.2.4(6).

15.2 Duties of Supervisor

The supervisor for the erection work shall have the following duties:

- to cooperate with the Purchaser in executing his duties.
- explanation of the erection instruction to the erection Contractor.
- to give correct instructions necessary for the erection work to the erection Contractor upon request of the Purchaser or the erection Contractor.
- to observe progress of the erection work and to give advice to the Purchaser when he acknowledged any delay in the progress.
- to evaluate the quality of each activities of the erection work and to give advice to the Purchaser when he acknowledged any defect in any activity.
- observation and dimension control of the equipment foundation.
- observation of cable works.
- to measure critical dimensions of essential components.
- to judge whether erection work may proceed to further erection milestone or not.
- to evaluate quality of the whole erection work and to give his comments on the results to the Purchaser upon completion of the erection work.

16. TRAINING OF PURCHASER'S PERSONNEL

16.1 General

The Supplier shall provide training to the Purchaser as the transfer of technology and developing expertise in the area of engineering, operation and maintenance of the Goods.

The number of man-days of training as detailed below shall be included in the Bids.

The Supplier shall be responsible for the development of the training module and program Schedule which shall be submitted to the Purchaser for approval.

The components of the training modules shall include but not be limited to training procedures/ methodology, module content instructional materials such as audio visual materials, tapes and slides, and manuals for each trainee.

During the conduct of the training program the Supplier shall employ qualified English speaking instructors.

16.2 Training at Supplier's Home Country

The Supplier shall train Purchaser's engineers for operation and maintenance. All expenses related to the training shall be borne by the Supplier and shall include but not be limited to travel expenses (international and in-land fares), lodging and per diems, travel and medical insurance, instructors fee, program and miscellaneous cost to be incurred during the training.

The training shall generally be divided on the following basis, subject to the approval of the Purchaser:

- Programming of DCS : Two (1) Engineers two(2) weeks
- Operation and maintenance of MMI : Two (2) Engineers two(2) weeks
- Calibration of transmitter : Two (1) Engineers two(2) weeks
- Mantenance of special instruments : Two (1) Engineers two(2) weeks

The cost of such training shall be included in the respective Price Schedules.

16.3 Operation and Maintenance Training at the Site

The Supplier shall provide a comprehensive training program related to design application, operation and maintenance, including trouble shooting of the Goods at the Site during erection work and Commissioning.

The content of the training program shall include but not be limited to:

- Pulverizer Operation and systems maintenance of coal firing system
- Operation and Maintenance covering electrical, mechanical and instrumentation and control

The training programs shall be submitted to the Purchaser for approval.

16.4 On the Job Training

The Purchaser shall provide operation and maintenance personnel to the Supplier for training under the direction of the Supplier for the purpose of on-the-job training.

All instructions shall be in English language.

In addition, The Purchaser shall provide operation personnel to make familiar to handle the simulator and to bring up the trainer for the power plant operator during initial start-up of the training simulator. The training simulator shall be used for the trainers under supervision of the Supplier's engineer(s) at least during six (6) weeks.

17. MATERIALS AND SERVICES TO BE PROVIDED BY THE PURCHASER

The Purchaser will provide the followings to the Supplier:

(1) Operational personnel

(2) Electricity and water needed for execution of the Contract

(3) Internal Tele-communication line

(4) Preparation of heavy oil needed for the boiler operation during the commissioning and trial run periods. The Supplier shall pay the cost of heavy oil consumed to the Purchaser at the rate of ( ) Tg per liter. The average heavy oil consumption of the existing boilers is as follows :

The total cost for the consumed heavy oil shall be shared by the Packag-1 and Packag-2 Suppliers at the rate of 3:1

When the boiler operation is stopped during the commissioning and trial run by an unexpected cause, the cost of heavy oil consumed during a succeeding boiler operation shall be bared by the responsible Supplier or the purchaser for the cause of interruption.

Whereas average heavy oil consumption for the boiler is as follows:

Attachment - A BID FORM "A"

Technical schedules

Item	unit	specification
1. DCS System Cabinet		
(1) Original Supplier and Type		
(2) Cabinet Quantity	Quantity	
(3) Cabinet size(WidexDepthxheight)	mm/per Cabinet	
(4) Condition for use(temperature,humidity)	℃,%	
2. DCS Controller		
(1) Model		
(2) CPU type		
(3) CPU performance	mHz	
(4) Processing cycle	msec	
3. I/O Module or Cards		
(1) Kind		
(2) Quantity	Quantity	
4. Plant Data Higway		
(1) Transmit method		
(2) Transmit capacity	Mbps	
(3) Max length(connection to connection)	m	
5. Maintenance tool for DCS Systems		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
(3) CPU type		
(4) CPU performance	MHz	
(5) Memory capacity (main)	Mbyte	
(6) Memory capacity (hard disc)	Mbyte	
(7) CRT		

Item	Unit	specification
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(c) Monitor size	Inch	
(8) CD-R drive		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(9) Printer		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(c) Print method		
(10) Condition for use(temperature,humidity)	℃,%	
6. Man-Machine-Interface computing units		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
(3) CPU type		
(4) CPU performance	MHz	
(5) Memory capacity (main)	Mbyte	
(6) Memory capacity (hard disc)	Mbyte	
(7) CRT		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(c) monitor size	inch	
(8) VDU		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(c) Monitor size	inch	
(9) Color Printer		
(a) Original Supplier and Type		
(b) Quantity		

Item	unit	specification
(c) Print method		
(10) Dot Printer		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(c) Print method		
(11) Condition for use(temperature,humidity)	℃,%	
7. Maintenance tool for MMI computing units		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
(3) CPU type		
(4) CPU perfomance	MHz	
(5) Memory capacity (main)	Mbyte	
(6) Memory capacity (hard disc)	Mbyte	
(7) CRT		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(c) Monitor size	Inch	
(8) Color Printer		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(9) Dot Printer		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(c) Print method		
(10) Condition for use(temperature,humidity)	℃,%	
8. Plant Simulator		
(1) DCS System Cabinet		
(a) Original Supplier and Type		
(b) Cabinet Quantity	Quantity	

Item	unit	specification
(c) Cabinet size(Wide×Depth×height)	mm	
(2) DCS Controller		
(a) Model		
(b) CPU type		
(c) CPU performance	mHz	
(d) Processing cycle	msec	
(3) Man-Machine-Interface computing units		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(c) CPU type		
(d) CPU perfomance	MHz	
(e) Memory capacity (main)	Mbyte	
(f) Memory capacity (hard disc)	Mbyte	
(g) CRT		
Original Supplier and Type		
Quantity	Quantity	
Monitor size	inch	
(h) VDU		
Original Supplier and Type		
Quantity	Quantity	
Monitor size	inch	
(i) Color Printer		
Original Supplier and Type		
Quantity	Quantity	
Print method		
(j) Dot Printer		
Original Supplier and Type		
Quantity	Quantity	
Print method		

Item	unit	specification
(k) Condition for use(temperature,humidity)	℃,%	
(4) Instructor & Maintenance tool for Plant Simulator		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(c) CPU type		
(d) CPU perfomance	MHz	
(e) Memory capacity (main)	Mbyte	
(f) Memory capacity (hard disc)	Mbyte	
(g) CRT		
Original Supplier and Type		
Quantity	Quantity	
Monitor size	inch	
(h) Printer		
Original Supplier and Type		
Quantity	Quantity	
Print method		
(i) Condition for use(temperature,humidity)	℃,%	
9. Uninterruptible Power Supply System		
(1) Panel Quantity	Quantity	
(2) Panel size(Wide×Depth×height)	mm	
(3) Battery Capacity	A-H	
10. Control Desks		
(1) Desk Quantity	Quantity	
(2) Control desk size(Wide×Depth×height)	mm/per desk	
11. Instrument Panel		
(1) Panel Quantity	Quantity	
(2) Panel size(Wide×Depth×height)	mm/per panel	
12. Control Drives		

Item	unit	specification
(1) Type		
(2) Quantity	Quantity	
(3) Condition for use(temperature,humidity)	℃,%	
13. Control Valves		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
(3) Condition for use(temperature,humidity)	℃,%	
14. Power Supply Switchgear(contactor)		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
(3) Condition for use(temperature,humidity)	℃,%	
15. Instruments for Burner Management System		
(1) Heavy oil shut-off valve		
(a) Original Supplier and Type		
(b)-Quantity	Quantity	
(2) Heavy oil burner inlet valve		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(3) Purge steam stop valve		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(4) Heavy oil pressure transmitter		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(5) Heavy oil temperature thermocouples with thermo-wells		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
16. Transmitter		
(1) Valve		

Item	unit	specification
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(2) Transmitter		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
17. Thermocouples		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
18. Thermo-Resistances		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
19. Furnace Brightness detector		
(1) Original Supplier and Type e		
(2) Quantity	Quantity	
20. Boiler Sampling Rack		
(1) Original Supplier and Type		
(2) Rack Quantity	Quantity	
(3) Rack size(Wide×Depth×height)	mm	
(4) Condition for use(temperature,humidity)	℃,%	
21. Conducitivity Analyzer		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
(3) Condition for use(temperature,humidity)	℃,%	
22. pH Analyzer		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
(3) Condition for use(temperature,humidity)	℃,%	
23. Silica Analyzer		
(1) Original Supplier and Type		

Item	unit	specification
(2) Quantity	Quantity	
(3) Condition for use(temperature,humidity)	℃,%	
24. hydrazine analyzer		
(1) Original Supplier and Type		
(2) Quantity		
(3) Condition for use(temperature,humidity)	℃,%	
25. Sampling Piping		
(1) Original Supplier and Type		
(2) Quantity	m	
26. Spot cooler		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
(3) Cooling Ability		
27. Flue Gas Oxygen Analyzer		
(1) Original Supplier and Type		
(2) Quantity	Quantity	
28. Cables		
(1) Power cable 1-cores	m	
(2) Power cable 2-cores	m	
(3) Power cable 3-cores	m	
(4) Power cable 4-cores	m	
(5) Control cable 2-cores	m	
(6) Control cable 4-cores	m	
(7) Control cable 10-cores	m	
(8) Control cable 12-core	m	
(9) Control cable 20-core	m	
(10) Compensation wire	m	
(11) Other type cables	m	
29. Terminal Panels and Terminal Boxes		

Item	unit	specification
(1) Original Supplier and Type		
(2) Quantity	Quantity	
(3) Panel size(WidexDepthxheight)	mm/per Panel	
(4) Condition for use(temperature,humidity)	℃,%	
30. Special Tools		
(1) External zero and span adjustments for Transmitters		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(2) Identification sheath(tube) printer		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(3) Market pens for vinyl and metal surface use		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(4) compression tools for terminal lug		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
31. Spare Parts		
(1) 21" SVGA monitor		
(a) Original Supplier and Type		
(b) Quantity	set	
(2) Lamp for 50" VDU display		
(a) Original Supplier and Type		
(b) Quantity	pcs	
(3) Serial printer		
(a) Original Supplier and Type		
(b) Quantity	Set	
(4) CD-R drive		

Item	Unit	specification
(a) Original Supplier and Type		
(b) Quantity	Set	
(5) Hard disc unit		
(a) Original Supplier and Type		
(b) Quantity	Set	
(6) QWERTY keyboard		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(7) 150mm vertical Indicators		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(7) O_2 sampling prove		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(8) O_2 sampling analyzer		
(a) Original Supplier and Type		
(b) Quantity	Quantity	
(9) Other necessary spare parts		

Attachment - A BID FORM "A"

Technical schedules

CLAUSE	Description	Reference No.
11.2.1 (3)	The number of times it has obsoleted its major control system over the last fifteen years.	TS-2-01
11.3.1 (1)	Dimensional drawing and typical component layout drawing (DCS System Enclosures)	TS-2-02
11.3.2 (7)	Design and manufacturing schedules for pulverizer	TS-2-03
11.3.2 (8)	Reliable inter-lock scheme	TS-2-04
11.3.7	Power consumption for the control and instrument system, capacity of UPS, required storage battery capacity in ampere-hour unit and dimensions of the UPS.	TS-2-05
11.3.8 (1)	Predicted arrangement of the control room	TS-2-06
11. 3.8 (2)	Dimensions and arrangement drawings	TS-2-07
11.3. 8 (3)	Dimensions and surface arrangement of the panels	TS-2-08
11.4.3	Method of resistance to erosion	TS-2-9
11.4.4	Selective method (duplicated transmitters)	TS-2-10
11.4.7 (2) (b)	KCl supply method and its interval (pH Analyzer)	TS-2-11
11.4.7 (2) (c)	Short measuring cycle (Silica Analyzer)	TS-2-12
11.4.7 (2) (d)	Analyzing method (Hydrazine Analyzer)	TS-2-13
12.10 (2)	List of measuring points (Transmitters)	TS-2-14
15.1 (2)	Dispatching schedule of the supervisors that includes period, man-month and duties of each supervisor and/or skilled worker	TS-2-15

Attachment - A BID FORM "A"

Technical schedules (Nominated Manufacturer List)

Name of Goods	Manufacturer	Country
DCS system cabinet(s) to mount all components		
Plant data highway cable		
DCS maintenance tool		
Man-Machine-Interface (MMI) to include all peripherals		
MMI maintenance tool		
Plan simulator system to consist of DCS Cabinet(s), DCS maintenance tool, MMI equipment, operator desk, instrument panel, instructor desk		
Uninterruptible power supply system		
Operator control desk		
Instrument Panel		
Control Drives		
Control Valves		
Power supply switchgears (contactors)		
Instruments for heavy oil burner control		
Transmitters including instrument valves		
Thermocouples and thermo-resistances		
Furnace brightness detectors		
Boiler sampling rack		
Analyzing Instruments		
Sampling Piping		
Spot cooler		
Flue gas oxygen analyzer		
Cables		
Terminal panels and terminal boxes		
Special tool for cabling work		

Attachment - A BID FORM "A"

Technical schedules

(Supervisors for Erection Work)

Occupation	Man-month

Attachment - A BID FORM "A"

Technical schedules

(Delivery Schedule after Effective Date of Contract in Months)

Occupation	Man-month
1. Delivery 1 (1st Unit)	
2. Delivery 2 (2nd Unit)	
3. Delivery 3 (3rd Unit)	
4. Delivery 4 (4th Unit)	