BHARAT HEAVY ELECTRICALS LIMITED

(A Government of India Undertaking)
HIGH PRESSURE BOILER PLANT
PURCHASE DEPARTMENT - Fossil Boilers
THIRUCHIRAPALLI - 620014
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ENQUIRY
(IMPORTS)

Vendor Code : Vendor Name :	Enquiry No	Enquiry Date	Due Date for Quotation
	1800700466 - 14	01.12.2007	15.12.2007
	Please quote Enquiry No, Date and due date in all correspondences. This is only a request for quotation and not an order		

Item	Description	Unit	Quantity	Delivery Quantity	Schedule Date
10	L015714220006001 Crude oil Handling Sysytem as per Specification COHS-001 and Annexures No. I, II, III, IV, Va,Vb, Vc, Vd, Vf, VIa, VIb and VII to the Specification. ENCLOSURES: 01. SPECIFICATION NO.COHS-001 REV:00 with annexures as listed above.	SET	1.000	1.00	24.03.08

General Note:

1. PLS SUBMIT THE FILLED-UP ANNEXURES (ENCLOSED) OF V(a), V(b), V(c), V(d) & V(e) ALONGWITH YOUR TECHNICAL OFFER AND SEND ALONGWITH OFFER.
2. PLS SUBMIT YOUR POINTWISE CONFIRMATION TO SPECIFICATION AND DATA SHEET.
3. VENDOR IS TO CONFIRM ALL OUR TECHNICAL, QUALITY REQUIREMENTS AND COMMERCIAL TERMS AND CONDITIONS WITHOUT ANY DEVIATION. DEVIATIONS IF ANY TO BE SPECIFICALLY INDICATED IN YOUR OFFER.
4. VENDOR TO ENSURE SUBMISSION OF PRICE OFFER AS PER SPECIFICATION NO COHS-001 CLAUSE 18.0 WITHOUT FAIL.
5. PLS QUOTE YOUR EARLIEST DELIVERY PERIOD.
6. THE PRICE IS TO BE QUOTED ON US DOLLARS AND ON CIF/SUDAN PORT BASIS.
7. THE QUOTED PRICE SHALL BE FIRM TILL COMPLETION OF THE CONTRACT. NO PRICE VARIATION IS ACCEPTABLE.

Enclosures:

"LD clause has to be confirmed without fail."

The offers should reach us before the time of opening of tenders.
The offers will be opened at 14:30 hours on the due date in the presence of the tenderers who may like to be present.
Late tenders are liable to be rejected.

Yours faithfully,
For **BHARAT HEAVY ELECTRICALS LIMITED**

MANAGER / PURCHASE
(Fossil Boilers)

BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI - 620 014

Fuel Systems / Product Engineering/ Fossil Boilers

Title: Specification for Crude oil Handling System

SPECIFICATION NUMBER: ***COHS-001*** *REVISION No. : 00*

Rev.No.	*Rev. Date*	*Description*	*Chd.& Appd.*

	Name	Signature	Date
Prepared	M.Thandapani S.Gomathinayagam		30.10.2007
Checked	S.V.Sivaramulu		30.10.2007
Approved	Dr.R.Sesharajan		30.10.2007

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1.0 Intent :

The intent encompass design, engineering ,approval from purchaser/ consultant , manufacture, inspection, testing at Contractor's / Sub- Contractor's works, certification, marking, identification and packing for shipment of parts, sub assemblies, pumping and heating skids , valves and fittings ,instruments, electrical and pneumatic accessories, cables and safety equipments / gadgets required to meet the design, safe operation and system requirements of crude oil handling system starting from tank out let to inlet of oil guns for a 4x 125 MW tangential fired boiler at Kosti-Sudan Project (4x125 MW).

Owner of the project : National Electric Corporation, Kosti / Sudan

Consultant for the project: Fitchner, Germany

Purchaser : Bharat Heavy Electricals Ltd, Trichirapalli, India.

2.0 Bidder's Scope of work

It shall be on the basis of a single point responsibility, completely covering the following activities and services in respect of all the equipment specified and covered under the specifications.

(a) Detailed design of all the equipment and systems.

(b) Providing engineering drawings, data, operation and maintenance manuals, etc. for the Purchaser/Owner's / consultant's approval.

(c) Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required.

(d) Complete manufacturing including shop testing / type testing.

(e) Sea worthy packing and transportation from the manufacturer's works to the site / Chennai sea port, India.

(f) Commissioning support for satisfactory operation of all the equipments and successful completion of initial operation.

(h) Guarantee tests after successful completion of facilities.

(i) Commissioning spares required during the commissioning of this system and Mandatory spares for 2 years trouble free operation

(j) Satisfactory completion of the contract.

Vendors contract responsibilities are furnished in Annexure – VII

3.0 Qualifying Requirements

The vendor shall have executed crude oil heating and handling system for minimum four similar utility units and are operating continuously for 2 years

4.0 General Description Of Steam Generator's Firing System

It is a box type, radiant heat, natural circulation and out door unit. It has a tilting tangential firing system.

Tilting Tangential Firing System Description

In the tangential firing system the furnace itself constitutes the burner. Fuel and Air are introduced to the furnace through four wind box assemblies located in the furnace corners. The fuel and air streams from the wind box nozzles are directed to a firing circle in the centre of the furnace. The rotative or cyclonic action that is characteristics the type of firing is most effective in turbulently mixing the burning fuel in a constantly changing air and gas atmosphere.

The fuel firing equipment consists of four wind box assemblies located in the furnace corners. Each wind box assembly is divided in its height into eleven sections or compartments. Each of the three compartments (fuel compartments) contains oil guns; the top, bottom and intermediate compartments are used for admission of secondary air (auxiliary air compartments), Twelve HEA ignitors are installed in the oil comportments of the main wind box. 12 optical flame scanners are installed in the fuel compartments for flame supervision. Refer these details in the annexed drawing No.3-FS-SUDAN-016 R0

Salient features of the boiler and firing system is as follows:

Unit capacity	4x125 MW
Superheated steam flow	415 t / h
Pressure of Superheated steam	131 kg / cm^2 (g)
Temperature of Superheated steam	540 ^{0}C
Feed inlet temperature	237^{0}C

Sl. No	Description	Remarks
01	**Fuel:**	
	Main fuel	**Crude Oil**
	Crude Oil properties	**Refer Annexure II**
	Capacity	To meet 100%MCR.
	Capacity in kg/hr	29000
	No. of firing elevations	3
	Total No. of oil guns	12 (4 guns at corners per elevation)
	No. of oil guns in service to meet 100% MCR	10
	Turn down required	3
	Start up Fuel	**Gas Oil**
	Gas Oil Properites	**Refer Annexure III**
	Capacity	To meet 10%MCR.
	Capacity in kg/hr	3000
	No. of firing elevations	1
	Total No. of oil guns	4 (at four corners of bottom elevation)
02	**Steam**	
	Pressure & temperature of steam available at pump house (for heating and tracing).	14 kg/cm^2, 250 ^{0} C
	Pressure and temperature of steam available at operating floor (for atomizing, scavenging and tracing)	14 kg/cm^2, 250 ^{0} C
03	**Air**	
	Pressure of steam available at operating floor (for atomizing & scavenging).	6 kg/cm^2 , ambient temperature

5.0 Crude Oil Handling System Description

Crude oil handling system scope starts at the inlet of pump house to the inlet of oil guns at boiler operating floors. The system description for the scope is as follows:

Pump House

Pump House is open roofed and located at a distance of 500 meters approximately from Boiler area and the pitch distance between boilers is 54 meters approximately. The pump house is common for four boilers. Refer Plot Plan PE-TG-250-100-M001 Rev.C. The fuel oil pipes from pump house to boilers are routed on pipe racks indicated in the above referred drawing. The pump house houses crude oil pumps, crude oil suction strainers, crude oil heaters, pressure control station for crude oil, steam flow control station for the heaters, drain oil tank, pump and suction strainer. The gas oil pumping system shown in the pump house will be provide by the purchaser.

The crude oil pressure control station shall be provided with 100% stand by with isolating valves and manual regulating by pass valve. Steam control station shall be provided with isolation valve and manual regulating by pass valve. The control valves shall be electric operated as mentioned in the C&I requirements.

Crude oil drawn from day oil tanks. Pumping the oil and heating it are the major preparatory function required on fuel oil for burning. Filtration of oil in one or more stages to remove any dust, dirt, sediments, sledge etc., also forms part of preparation. This renders long trouble free service life to pumps, valve and oil guns. It reduces wearing and clogging of atomizers nozzles.

Because of high pour point and waxy nature, Crude oil(CO) requires preheating at day tanks to about 60°C. There are coarse strainers at pump suction. Heater succeeds the pump.

The pump delivery header pressure is maintained constant at all firing rates by a pressure maintaining cum regulating valve, that relives the excessively pressurised oil to the day tanks.

Maintaining the (CO) Crude oil temperature constant, corresponding to the atomizing viscosity of 20 centistokes is essential for correct fuel atomization level. Control system regulates the oil temperature by controlling the condensate level inside the heater (If steam is the heating media). Such a level control principle helps in keeping the heating steam pressure / temperature always constant and the steam pressure above that of oil pressure at all loads, which avoids any leakage of oil into steam side. A lower oil temperature impairs the

burner performance and a higher temperature causes oil cracking and results in fast atomizer blockage.

Crude Oil piping

Crude Oil from the pump house is taken to the boilers through long discharge lines. The crude oil delivery pipes are routed through the pipe racks connected to the individual boilers. For routing of the pipe racks, refer attached plot plan **PE-TG-250-100-M001 Rev.C.** The crude oil pipes shall be heat traced and insulated to maintain the temperature marginally above firing temperature (ft) indicated in the scheme attached. The pipe rack also houses the drain lines and crude oil return lines from individual boilers to the tanks. The pipe rack also houses the gas oil lines routed by the purchaser. If the tracing medium is steam, steam traps shall be provided with isolating valves and by pass valve (trap stations) at every 35 metres. The crude oil delivery lines from pump house are connected to crude oil piping at operating floors of individual boilers with isolation valves.

Crude oil re circulation

The Crude oil heater sets are located in the pump house at approximately 500 meters from the boiler. Refer plot plan attached. Before putting the first burner into service, it is necessary to warm up the long oil supply lines from the heater to the burners, so that the oil does not get cooled in the cold lines and that the oil at correct atomizing temperature become available at the burners. To achieve this the heated oil is circulated up to the burners and back to day tank through fuel oil return lines, till design temperature levels are reached at near the burners.

For faster initial line warming up, which is often referred as ‘cold purge’, there is a valve in the return line. When the first burner is cut in, this valve is closed. However a small amount of hot oil is constantly re circulated through a restricted opening of the above valve. During initial commissioning activities the regulating valve opening has to be set, corresponding to a re circulation quantity of 10% of maximum firing rate.

The Crude oil master trip valve could be opened even before furnace purge if this cold purge valve is open and all the burner nozzle valves are closed. Once the first pair of oil guns are cut in, this purge valve is closed.

Cold purging activity takes considerable time and this preparatory work is normally started 2-3 hours prior to the planned boiler / burner startup on Crude oil.

Boiler Operating Floors

Boiler operating floor for crude oil & gas oil system is located at Boiler Floor elevation 11.25 Meters. Refer Drawing 3-FS-SUDAN-014 R0. The operating floor houses the crude oil discharge strainers, crude oil flow measuring station, crude oil main trip valve, crude oil flow control station and instrumentation headers. It also houses the atomizing steam line with steam control station and instrumentation headers.

The discharge strainers shall be provided with 100% stand by with isolation valves a upstream and downstream. Refer strainer data sheets attached for type, size and filtration level.

Crude oil flow control valve shall be electric operated as mentioned in the C&I requirements (Clause 8.0). Crude oil flow control valves shall be provided with isolating valves at upstream and downstream and manual regulating by pass valve. Flow control station shall be provided with isolation valve and manual regulating by pass valve. The flow meter will be provided by the supplier as mentioned in the clause 8.0

Crude oil piping in the operating floor also houses the instrumentation header with instruments. Refer clause 8.0 for scope and requirement.

The crude oil delivery pipes connected to the crude oil ring header. Raisers at four corners from the crude oil header connected to the burner stations located at four corners at each elevation. Crude oil header is sufficiently sized to take care of pressure fluctuations resulting from oil guns cutting in. Return lines are connected through three way return trip valve which is pneumatic operated. Refer data sheets attached for the details. For port connections and operating philosophy, refer scheme attached (Annexure IV).

Burner Stations

Burner stations are skid mounted and are mounted at four corners of operating floors near three elevations. Refer Drg. No. 3-FS-SUDAN-014 R0 and 3-FS-SUDAN-015 R0. Floor at 11.25 Meters houses the burner station for bottom 2 elevations. For the top elevation the burner station is located at 13.65 M. Crude oil burner station houses the burner trip valves for crude oil, steam. Scavenging valves are provided on lines interconnecting crude oil and atomizing medium lines. These valves are also referred as corner valves or nozzle valves Crude oil burner station also contains the flexible hoses for the crude oil and steam up to inlet of oil guns. For location of burner stations refer drg. 3-FS-SUDAN-010 R0.

The burner trip valves are quick closing and slow open type and are pneumatic operated. Refer data sheets attached for details and voltage ratings.

Burner connections may be steel armoured flexible hose or swivel joint type. Flexible hose shall be double wall type with welded (not brazed) connections . A pressure gauge may be used to monitor the annular space and warn for any leakage. Drip pan shall be installed below each l burner floor level . It shall be provided with water sealed drain

The sizes of hoses from burner station to the inlet of oil gun shall be of following sizes:

1. 25.4 mm ID; FM x SF ¾ " NPT (oil)
2. 19 mm ID ; FM x SF 1" NPT (Steam)
3. NB 25,150# Flanged (Oil purging)
4. 6.35 mm ID; 1000 L FM x SM ¼"NPT (for ignitors)

Coolers:

Crude oil coolers with isolation and bypass valves hall be provided in the return oil lines to bring the return crude temperature to maintain at 60 deg.C (pumping temperature).

Drain Oil System

All Crude Oil drains and Gas oil drains from different equipments and piping etc. of a Steam Generator shall be brought by gravity to a common drain oil tank provided for each Steam Generator. The oil collected in this tank shall be periodically pumped back to the Crude Oil Storage Tanks. Drains from the oil pressurizing pump house and common oil piping shall be taken by gravity to one common drain oil tank in the pump house area and pumped to Crude Oil Storage Tanks. Necessary safety aspects shall be complied with the terminal point as given in the annexure.

Condensate system for Crude Oil tracing lines

Condensate from complete Crude Oil plant shall be brought to a common condensate flash tank. Drains from this condensate tank shall be connected to station drains.

6.0 Crude Oil Handling System Scope of Work and design criteria:

6.1 System Scope:

1. Crude oil suction strainers, pumps with motor, pressure control stations as specified above with necessary isolation and bypass valves mounted on a common frame with foundation bolts. This is for

two sets of systems and each system to meet two boiler requirement as shown in the scheme

2. Crude oil heating system with temperature control station as specified above, mounted on a frame with foundation bolts. This is for two sets of systems and each system to meet two boiler requirement as shown in the scheme

3. Inter connecting piping from pump house inlet to pump house outlet and crude oil piping from pump house outlet up to oil guns inlet.

4. Crude oil tracing system and trap stations and condensate piping up to a common terminal point near to condensate flash tank.

5. Discharge strainers for crude oil strainers with 100% standby at operating floors.

6. Flow measuring station for crude oil in operating floors (excluding flow meters).

7. Flow control station for crude oil & steam as specified above in the operating floors.

8. Crude oil re circulation valves, isolation valves, non return valves and 'Y' strainers.

9. Instrumentation headers with necessary fittings for crude oil & steam as specified above and in C&I requirements (Clause 8.0). Refer scheme attached.(Annexure IV).

10. Crude oil headers around the furnace and the risers at four corners connecting to the burner stations as specified above.

11. Provisions with isolation and drain connections with valves for flushing of entire crude oil system with gas oil shall be provided by the vendor. The flushing connections shall be provided at pump suction at pump house and at operating floor. Refer the schemes attached for reference.

12 Master trip valves for crude oil, burner stations with burner trip valves or corner nozzle valve for crude oil, steam and scavenging

13. Pressure relief valves in lines, drains and vents.

14. Crude oil piping with tracing system and steam trap stations at every 35 m (if steam is the tracing medium) from tank outlet to oil gun inlet with necessary valves, fittings, fasteners and pipe supports.

15. Condensate piping up to common point near the condensate flash tank. For location of condensate flash tank refer plot plan (Annexure IV)

16. Drain oil tanks with heaters, pumps, strainers, electric operated steam control valves pump house and boiler are as specified.

17. Steam pipe connection from operating floors to drain oil tanks at boiler area.

18. Hoses for crude oil and steam from burner stations to inlet of oil guns.

19. Return oil coolers

20. Ventillation systems.

21. Spillage collection systems and safety related equipments

22. Gas leak detection systems and alarms.

23. MCC, cables, gauges, switches, junction boxes instruments as specified in clause 8.0

24. Out put requirements to meet the burner management system.

The list indicates only major items envisaged for the crude oil handling system and bidder to go through the complete documents referred in the clause 8.0 and to ensure the supply of all components necessary for the successful operation of the system.

6.2 Design Criteria

Design criteria to be taken into consideration for the scope of work described is narrated below.

1. Design criteria for the equipment selection,

2. Design criteria for the system

3. Design criteria for the operation
4. Design criteria for the maintenance
5. Design criteria for interface
6. Design criteria for safety.

6.2.1 Design criteria for equipment selection:

The crude oil handling system shall be designed to meet the following parameters at the inlet of each oil gun:

Maximum rating:

Crude oil flow : 2900 kg/hr

Crude oil pressure : 13.5 Kg/cm^2 (g)

Crude oil temperature : 130 deg. C

Steam flow : 200 N m^3/h

Steam pressure : 5.25 Kg/cm^2 (g)

Minimum rating:

Crude oil flow : 900 kg/hr

Crude oil pressure : 3.5 Kg/cm^2 (g)

Crude oil temperature : 130 deg. C

Steam flow : 270 N m^3/ h

Steam pressure : 5.25 Kg/cm^2 (g)

The Crude Oil handling system shall meet the following design criteria, operation and safety aspects:

Crude Oil Pumps:

No. of pumping system : 2

Pumps / system : 3

Total number of pumps : 6

Type of pump : triple screw positive displacement pump

Type of drive : Electrical.

Capacity of each pump : 685 Liters Per Minutes(LPM) + 10%

Temperature of crude oil : 60 deg.C

Pump suction head : (-) 0.5 Kg/Cm^2 (g)

Head to be developed : to meet the oil flow parameters at oil gun inlet.

Drain Oil Pumps:

Pumps at boiler area : 4

Pumps at Pump house : 1

Total number of pumps : 5

Type of pump : Gear pump

Type of drive : Electrical.

Capacity of each pump : 75 LPM + 10%

Temperature of oil : 60 deg.C

Pump suction head : (-) 0.5 Kg/Cm^2 (g)

Head to be developed : 10 kg/cm^2

Bidder to specify the material of casing, shaft and type of bearings in the data sheets attached (Annexure- V). Each pump shall be fitted with integral safety relief valve.

Each pump shall be heat traced and shall have mechanical seal with suitable fluid to minimize wax buildup. Both the pump casing and seal areas must be kept warm to minimize shock to a cold pump. By this, the standby pump can be safely started.

Heaters:

(i) Type : Steam heater / Vendor to specify(**)

(ii) No. of Heating systems : 2

iii) No. of heaters/system : 3

iv) Total No. of heaters : 6

(iii) Capacity of each heater : 685 LPM

(iv) Heater inlet Crude Oil temp. : 60^{o}**C** (for sizing the heater necessary allowance may be considered)

(v) Heater outlet temp. :130^{O}C Max

(vi) Heater Design/ Construction :TEMA, ASME Boiler and pressure normal code, HEI Standards, USA. Pipe connections to heater as per TEMA class C BEU type or Vendor to specify

(vii) Heater Tubes :Seamless / Vendor to specify

Tube bundles of Crude oil heaters shall be of removable design.

(**) In case any alternate heating and tracing system is proposed by the vendor in place of steam heating and tracing system, vendor shall provide the complete details of the system proposed and installation reference of such system in operation at least five places of similar capacity.

Drain oil tanks:

No. of tanks at boiler area : 4

Capcity of tank at boiler area : 3 m^3

No. of tanks at pump house : 1

Capacity of tank at pump house : 4 m^3

Total number of tanks : 5

Applicable international standards and codes of practice for design and construction of tanks shall be followed.

Heaters shall be provided at the bottom of drain oil tanks to maintain the oil temperature (60 deg.C) to facilitate its pumping. The heaters shall be sized considering ambient air temperature of 10 degree Celsius. Total heating surface of heaters shall be provided by the vendor.

Strainers:

Suitable strainers shall be provided in the fuel oil line. Refer Data sheets attached in Annexure V.

Piping:

No of forwarding piping streams from pump house to boilers:

2 (each to meet the requirements of 2 boilers)

No of return piping streams from boilers to pump house : 1

The piping, valve and fitting connections shall be socket welded to avoid any Leakage. Piping fittings shall be of carbon steel butt welded connection (where possible) conforming to ASTM-A 234 (or approval equivalent standard). All flange connection, shall conform to ASME B16.5 (or approved equivalent standard) and shall be suitable to withstand design conditions of system, to which they are connected.

For line sizes refer the schemes attached in Annexure IV

Trip valves, Nozzle Valves and Control valves:

Crude oil trip valves & individual burner nozzle valve solenoid shall be:

(i) Dual coil heavy duty construction having class 'H' insulation with explosion proof

(ii) Having closing time less than one (1) second

(iii) Designed for operating voltages as under:

(a) Trip valve solenoid 110 Volts DC

(b) Nozzle valves solenoid 110 Volts AC

Crude oil Trip valves, nozzle valves and control valves shall be suitable to handle oils at temperature / pressure required at the burners. Further, these valves shall confirm to ANSI leakage Class-VI under shut off pressure conditions of respective pumps.

Trip and Nozzle valves shall be pneumatically operated and Control valves shall be electrically operated.

Valves:

(i) Type of valves (for oil services): NB 200 and above – Plug valve
Below NB 200 - Ball valve
leak proof, fire safe as per applicable standard.

(ii) Material of valves on crude oil lines: Cast/ forged steel

(iii) Material of valves on steam / condensate lines : Cast/forged steel

Instrument root valves on crude oil oil lines shall be of minimum 25NB size with body rating as per process condition. Considering the safety aspects in oil line, valve connections shall be designed for welded ends with pipe.

6.2.2 Design criteria for the system:

The Crude Oil firing system shall have following design features:

(a) Heat (Steam) tracing for all lines. Provide suitable tracing in non drainable area.

(b) No cooled legs in crude oil supply / re-circulation piping as well as in instrument tappings.

(c) On longer lengths of crude oil pipes between isolation valves, pressure relief valves shall be provided.

(d) In both upstream and down stream sides of Crude Oil lines isolation valves shall be provided for equipments like pumps, heaters, flow meters, filters, control valves etc, which are required to be taken out for maintenance.

(e) Facility for flushing of complete system handling Crude Oil by Gas Oil.

(f) Steam flushing points with isolation valves shall be provided for cleaning during commissioning.

(g) While heating the crude oil, light distillates are likely to evaporate and become volatile. While designing heaters, Control valves, Strainers and other crude oil firing system components, care shall be taken to consider this factor in to account

(h) The handling system shall be duly designed for the appropriate hazard area classification for the applicable NEMA / IEC standards/ codes

6.2.3 Design criteria for the operation::

The design of Crude Oil system shall ensure compliance with the following operational requirements:

(a) Facilities for Auto start of standby Crude Oil

(b) Pressuring pumps in event of tripping of any running pump or low oil pressure.

(c) Facility for Auto start and shutdown of drain oil pumps in conjunction with level in the drain oil tanks.

(d) Facility for automatic as well as manual start / ignition of oil burners (in association with FSSS/ BMS)

(e) Maximum turn down ratio, for the oil burners (without needing burner tip changes)

(f) Automatic purge interlock to facilitate restarting of oil firing system after prior tips / shut down of oil firing.

(g) Means of determining oil flow to each burner like calibration curves and pressure measurements at the burner as a minimum requirement.

6.2.4. Design criteria for maintenance:

Following maintenance facilities shall be provided in the Crude Oil system for the Steam Generator:

a) Fixed drip trays with easy means of emptying for each oil burner to contain

any oil leakage with suitable safety system to drain the oil to drain oil tank.

b) Oil gun cleaning station and the facility for blow off of the oil guns using auxiliary steam at all three firing floor. For this purpose auxiliary steam tapping with necessary isolation valves and necessary hose connection shall be provided.

6.2.5 Design criteria for Interfacing with other Systems / equipments

Following features shall be provided for interfacing with other Systems / equipments:

a) Adequate local instrumentation such as temperature, pressure, differential pressure, flow transmitters for independent high and low signaling contacts required for Burner management system and other interlock/alarm.

b) Adequate potential free contacts for status of individual pumps.

c) The Crude Oil handling and firing system shall be designed to function total association with the Purchaser's Furnace Safeguard Supervisory System

6.2.6 Design criteria for Safety:

Crude oil heaters shall be completely covered with liquid to prevent hot spots from developing that may exceed the auto ignition temperature (API publication 2023 may be referred). While heating the crude oil, light distillates are likely to evaporate and become volatile. While designing heaters, Control valves, Strainers and other crude oil firing system components, care shall be taken to consider this factor in to account.

Static electricity:

The system shall be designed taking into account of the hazards arising out of static electricity and shall confirm to international codes

Fire suppression system for Crude oil firing system

Suitable fire suppression system shall be designed for the pump house and operating floor according to the applicable standards and practice.

Combustible gas detector.

As the crude oil vapours are heavier than air , the accumulation pose high risk

of fire . Hence Combustible gas detector. Shall be installed in the burner front area and other potentially hazardous areas viz., lower boiler rooms, pump room, and indoor control valve room whichever applicable and will alarm on a panel in the control room. It shall be connected to area control console containing an alarm with an indicator / recorder

Ventilation

Ventilation shall be provided at respective burner elevation platforms, pump houses, drain oil tanks.Ventilation should be designed to prevent flammable vapours from crude oil leak accumulating form a concentration greater than 10 % of the lower inflammable limit.

As crude oil vapors are heavier than air, vapors which are likely to be formed in the boiler front shall be diffused effectively by exiting ventilation fans blowing air across the boiler front by suitable method. Vendor may select an appropriate system based on their experience.

7.0 Applicable Standards:

The crude oil handling system design , equipment selection , component design, inspection and testing shall conform to the relevant international codes and standards viz., ASME / ANSI / NFPA/ API / IEC/ NEMA/ etc.,in addition to the following standards / codes

i. Crude oil as a Burner Fuel **-** API publication 2215 latest edition with the related standards included as referenced publications as applicable to the intended system

ii. NFPA code 30; Flammable and Combustible liquids.

iii. API Recommended Practice 2003: Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents (1998).

iv. Piping shall confirm to ANSI B31.3, valves to API 6FA

v. API. Standard 2015: Safe Entry and Cleaning Petroleum Storage Tanks.

vi. API. 1998. Standard 650: Welded Steel Tanks for Oil Storage. Washington

vii. NFPA 85

viii. KKS coding system for fuel oil lines, valves and equipments

8.0 C&I Requirements:

The scope of Engineering pertain to the following:

Submission of Process control schemes along with write-up, to suit the sensors and control drives indicated in the preliminary Fuel oil scheme P&IDs (3-FS-SUDAN-001 to 011 – 11 sheets) envisaged by BHEL, to meet the process requirement, in order to configure the same in DCS arranged by BHEL.

Provision of recommended Interlock and protection schemes to meet NFPA requirement based on the Instrumentation provided in the preliminary Fuel oil scheme P&IDs (3-FS-SUDAN-001 to 011 – 11 sheets) envisaged by BHEL, in order to take care of the same in Burner Management System arranged by BHEL.

All the control valves shall be provided with Electrical actuators with integral starters, position feedback transmitters and limit switches. These actuators shall be suitable for operation at 415 $\pm$ 10% V AC, 50 Hz, 3 Phase electrical power supply.

All the trip valves and nozzle valves shall be provided with solenoid valve operated pneumatic actuators and position limit switches. The main trip valve and Corner Nozzle valves shall be designed for 110 V DC and 110 AC respectively.

Scope of supply for Electrical and C&I :

The following are the Instruments included under the scope of supply of the Vendor/agency:

All instruments namely Pressure/Temperature switches and gauges except the instruments indicated under exclusion list, shown in the Fuel Oil schemes, as per the enclosed specifications suitable for the process shall be supplied.

In case of Pressure/Temperature switches used for alarm/interlock, each switch shall be supplied with (2 NO & 2 NC) or 2 SPDT potential free contacts, for BMS system interface.

Erection materials required for erection of all the instruments shall be included under the vendor/agency scope of supply.

Commissioning spares and essential spares for two years operation shall be included. Unit price for all the items shall be indicated, along with validity period.

General technical conditions for Electrical and C&I:

The following are the technical conditions for the Instruments & drives supplied by the vendor/agency:

All control valves shall accept 4-20 mA demand signal and provide 4-20 mA two wire position feedback signal required for DCS operation.

All the trips valves, nozzle valves and isolation valves shall be supplied with 2 NO and 2 NC or 2 SPDT potential free contacts for interfacing to BMS system.

All the Limit switch contacts, Solenoid valve connections shall be prewired to an integral junction box, suitable for the Hazardous area classified.

All the DP instruments shall be supplied with 5-valve manifold.

All the instruments shall be supplied with Instrument Isolation valves for maintenance purpose.

Documents to be Submitted for Electrical and C&I :

The following documents / details shall be furnished along with the offer:

a. Recommended auto control loops.
b. Write up for the Control system.
c. List of interface signals required from other systems.
d. Schedule of Instruments.
e. Schedule of drives.
f. Utility (power, cooling water, instrument air, service air) requirement.
g. List of Commissioning spares.
h. List of spares for 2 years trouble free operation
i. Suppliers' catalogues for the offered equipment.
j. Compliance to each clause of this specification and QP.

The following documents shall be furnished after placement of purchase order:

a. Instrument erection drawings.
b. Electrical Wiring diagram and Pneumatic Hook-up diagram

c. Filled in data sheets (for approval)
d. Quality plan (for approval)
e. Utility requirement
f. Equipment Data sheet
g. BOM for complete system with erection details
h. Storage instruction and erection guide lines.
i. Equipment handling procedure
j. Material test certificates

The following documents shall be included along with the main supply:

a. 6 sets (Minimum) of Operation and maintenance manuals in addition to one Soft copy in CD, with contents similar to mechanical system.
b. Sets of test certificates
c. Packing and shipping details

Terminal points for Electrical and C&I:

a. In case of pressure measurements, root valves provided in the main process pipes.
b. In case of Temperature measurement, stubs provided threaded caps or sealing flanges.
c. In case of, electrical signals, all signal/control cables shall be terminated in integral junction boxes.

Exclusion for Electrical and C&I :

a. Instrumentation, power and control cables from the terminal points indicated under cl. 6.5.0.c above.
b. Flow meters for Crude oil and Gas oil.
c. Pressure transmitters, RTDs, Thermocouples used for interface with DCS, arranged by BHEL.
d. Furnace flame scanners along with scanner cables.

Optional items :

a. Offer for Flame scanner shall be submitted along with unit price.
b. Offer for Flame scanner cable with FRLS outer sheath shall be submitted along with unit price.

9.0 Documents to be referred by the bidder:

The drawings and documents listed below and forming part of the specification shall supplement the requirements specified herein. The scope and terminal points of the equipment to be furnished under this package shall be as identified in these drawings & documents and read in conjunction with text of the specification:

i) Annexure - I Site conditions
ii) Annexure – II Crude oil properties
iii) Annexure – III Gas oil property
iv) Annexure – IV List of Drawings enclosed.

a) 3-FS-SUDAN-001 R0 to 002, 004 to 006 & 008 to 011) Fuel oil scheme (9 Drawings)

b) 3-FS-SUDAN-012 R0 FO Pump House Layout
c) PE-DG-250-100-M001 / Rev.C Plot plan
d) 3-FS-SUDAN-016 R0 Disposition of Wind box
e) 3-FS-SUDAN-013 R0 GA of boiler-Side Elevation
f) 3-FS-SUDAN-014 R0 Floor Plan at 11250
g) 3-FS-SUDAN-015 R0 Floor Plan at 13650

v) Annexure – V Typical Data sheets
a) Fuel oil pump
b) Fuel oil pump motor
c) Strainers
d) Trip Valves
e) Control Valves

vi) Annexure – VI Typical Quality plan
a) Air Cooled Oil Gun Assy. – 4 pages.
b) Oil Preheating and Pressurizing Unit – 4 pages

C&I :

a) Product specifications (6 Nos.)
1) Pressure/DP Switch.
2) Temperature switch with Thermo well.
3) Pressure Gauge (Bourdon type)
4) Pressure Gauge (Chemical seal diaphragm type)
5) DP Gauge.
6) Temperature Gauge with Thermowell

b) List of applicable QPs

10.0 Packing:

The equipments, assemblies, skids shall be done with seaworthy packing in such a way that it does not get damaged during transport. It shall be properly covered with thick tear proof polythene sheet and dispatched in suitable moisture proof wooden / steel crates

11.0 Painting :

Painting shall be done as per the applicable standards.

12.0 Special Tools :

Necessary tools as required for the system shall be supplied.

13.0 Documents to be furnished by the bidder:

The following documents / details shall be furnished along with the offer.

25. P&ID for Crude oil handling firing system
26. P&ID for any other system as envisaged by vendor
27. Interface and terminal details for the offer
28. Write up for the system
29. Utility requirement
30. Total cross sectional assembly drawing with BOQ.
31. Filled in data sheets (Annexure).
32. Commissioning spares required
33. List of spares for 2 years trouble free operation
34. Suppliers' catalogues for the offered equipment.
35. List of Boilers supplied with crude oil firing and its equipments.
36. Compliance to each clause of this specification and QP.

The following documents shall be furnished after placement of purchase order.

II. Filled in data sheets (for approval)
III. General Arrangement and Cross Sectional Drawing (for approval)
IV. Quality plan (for approval)
V. Lubrication details
VI. Utility requirement

VII. Sizing calculation of equipments and lines.
VIII. Pressure drop calculation
IX. Equipment filled in Data sheet
X. BOQ for complete system with erection details
XI. Storage instruction and erection guide lines.
XII. Foundation and load details
XIII. Equipment handling procedure
XIV. Material test certificates
XV. Packing and Shipping details
XVI. Electrical Wiring diagram and Pneumatic Hook-up diagram
XVII. Insulation calculation and material selection
XVIII. Insulation drawing with BOQ.

Drawings and Erection Details for submission.

I. Fire suppression system in burner area
II. Ventilation system
III. Gas leak detection system
IV. Hazardous area classification
V. Burner connections
VI. Documents, data sheets, Working instructions, drawings and Test certificates for the complete system.
VII. Burner performance curves for Crude oil and Gas oil.

The documents to be supplied along with the main supply shall include the following.

I. 6 sets (Minimum) of Operation and instruction manuals in addition 1 Soft copy in CD.
II. sets of test certificates

III. Packing and shipping details

In addition to submission of drawings as stipulated above Contractor shall also furnish the data / documents with respect to following as mentioned elsewhere in the specification.

(ii) Sizing calculations
(iii) Pressure drop calculations.
(iv) Equipment data sheets.

O & M manuals:

O&M manuals are to be supplied both in CD and hard copy.

Hard copy Manuals shall be in printed form.

Drawings shall be of printed or laser printed only.

Spiral or comb bound copies should be totally avoided.

If manuals are supplied in folders, the folder shall have 3 hole punching system.

O & M manuals, shall be submitted to BHEL/ Tiruchirappalli prior to despatch of the equipment

Manuals, generally should contain the following:

I. Data sheet for components and drives
II. Brief description of the equipment
III. Storage, installation and Operation procedure
IV. Maintenance (including lubrication, where necessary) and service.
V. Recommended spares list for 2/3 years trouble free service.
VI. Calibration and trouble shooting procedures
VII. Assembly drawings with part list, dimensional drawings & other certified drawings.
VIII. Manuals should pertain only to the type or model supplied for a particular order. Copies shall be sent to BHEL / Tiruchirappalli

14.0 Guarantee :

14.1 The crude oil handling system shall be guaranteed for the following parameters at the inlet of each oil gun:

Maximum rating:

Crude oil flow : 2900 kg/h

Crude oil pressure : 13.5 Kg/cm^2 (g)

Crude oil temperature : 130 deg. C

Steam flow : 200 $N.m^3/h$

Steam pressure : 5.25 Kg/cm^2 (g)

Minimum rating:

Crude oil flow : 900 kg/hr

Crude oil pressure : 3.5 Kg/cm^2 (g)

Crude oil temperature : 130 deg. C

Steam flow : 270 N m^3/h

Steam pressure : 5.25 Kg/cm^2 (g)

14.2 Auxiliary power consumption for crude oil pumps, drain oil pumps.

14.3 Steam consumption for the crude oil heaters.

In case any alternate heating and tracing system is proposed by the vendor in place of steam heating and tracing system, vendor shall guarantee for the auxiliary power consumption, consumption of heating fluid of the alternate system.

Vendor shall furnish guarantee for the trouble free service and for the intended performance stated in the specification for a period of 18 months from the date of operation / 24 months from the date of dispatch whichever is earlier.

15.0 Quality requirements:

Manufacturer typical Quality requirement are enclosed in the Annexure -VI
Vendor shall submit the Quality Plan for the approval of the purchaser and shall comply to the requirement of the Purchaser.

16.0 Deviation:

Vendor shall highlight the deviations from the specification / scope(if any) and/or special features of the system, which are not covered in the specification during the offer stage itself.

Deviations, if any, should be very clearly brought out, otherwise, it will presumed that the Bidder's offer is strictly in line with this specification.

17.0 Exclusions:

Gas oil system is excluded from vendor scope of supply. Gas oil system explained in this specification is for information of the vendor.

18.0 Offer Required:

Vendor shall furnish break up offer with price for the scope of the system as indicated below.

Sl. No	Nature	SCOPE	REFERENCE DRG
01	Basic offer	Pump house inlet to oil guns inlet for crude oil handling system including C&I portion for crude oil handling system.	3-FS-SUDAN-002/R0
02	Take off price	Pump house outlet to operating floor inlet	3-FS-SUDAN-002/R0
03	Take off price	C&I portion	---
04	Seperate Offer	Commissioning support / man day	---
05	Separate Offer	Training at Owners' premises / man day	---
06	Separate Offer	Training at Purchasers' premises / man day	---

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TERMS AND CONDITIONS

I OFFER :

Offer in ENGLISH LANGUAGE AND IN TRIPLICATE in a SEALED COVER SUPERSCRIBING the enquiry number and the due date shall be submitted addressed to :

THE MANAGER/[redacted] PURCHASE / FB
BHARAT HEAVY ELECTRICALS LIMITED
HIGH PRESSURE BOILER PLANT
TIRUCHIRAPPALLI - 620 014
TAMIL NADU
INDIA

Offers should be firm for cost, insurance and freight (CIF) Sudan Port price, indicating the shipping specifications and the earliest delivery inrespectof offers from overseas suppliers. Offers from indigenous sources shall be firm for FOR TIRUCHIRAPPALLI.

II DOCUMENTS :

(i) Offers should be accompanied by detailed technical literature, catalogue and detailed dimensional drawings in ENGLISH and in TRIPLICATE, or otherwise, the offers will not be considered.

(ii) Incase overseas suppliers route their offer through their accredited selling agents, a letter of authority should be furnished mentioning the name and address of their selling agents, who are authorised to bid, negotiate and conclude a Contract on their behalf.

III AGENCY COMMISSION :

(i) Inrespectof offers from overseas suppliers, agency commission, if any, payable to their agents in India, shall invariably be shown separately in the proforma invoice and this will be paid by us in India, in Indian Rupees, on satisfactory completion of the Contract.

(ii) If Oversees Principal has any tie-up with any third party in respect of Agency Commission it should be declared while submitting offers.

(iii) Copies of current Agency Agreement/Authorization Letter in respect of Agency Commission shall be furnished alongwith offer, if not made available earlier.

(iv) For calculation of Rupee equivalent of Agency Commission, exchange rate as prevailing on the date of order will be taken.

IV SPARES :

The tenderer should quote separately for spares that are required for two years trouble free operation. The spares offer should accompany the offer of main equipment, otherwise the quotation will be overlooked.

V VALIDITY :

The offers for main equipment and spares shall be kept open for acceptance for 120 days (one hundred and twenty days) from the date of opening of the tender.

VI. TEST CERTIFICATES, OPERATING AND MAINTENANCE MANUALS :

The tenderer shall clearly mention in their offer, that Test Certificates and Operating and Maintenance Manuals, etc., as called for in the technical specification, in the required number of copies will be provided at no extra cost. If any amount is payable as extra, the same shall be indicated separately in the offer.

VII TERMS OF PAYMENT :

In the event of an order the purchaser will arrange for an irrevocable letter of credit against presentation of documents. Under no circumstances confirmed and irrevocable letter of credit will be established by the purchaser.

VIII GENERAL :

(i) Preference will be given to suitable indigenous or ex-stock imported offers, failing which imported offers from incoming consignment against the indigenous supplies "Stock and sale licence" will be accepted. If "Stock and sale licence" is not available with the indigenous suppliers, the same shall be indicated in their offer.

(ii) Bank Guarantee : The supplier in the event of an order, should furnish a bank Guarantee from an approved Bank at no extra cost in a proforma which will be supplied to the Supplier, alongwith the order, for an amount equivalent to 10% of the value of the contract. The Bank Guarantee should remain in full force and effect during the period that would be taken for successful completion of the contract and shall continue to be onforceable till 12 months from the date of receipt of consignment at purchaser's site or 18 months from the date of last shipment at the Port of Delivery whichever is earlier.

IX LD / PENALTY AND INTEREST ON ADVANCES FOR DELAY IN DELIVERY :

"If the Supplier fails to delivery the Raw Materials/equipment/components within the period specified in the contract the Purchaser shall deduct Liquidated Damages a sum equivalent to 0.5% of the price for each week of delay upto a maximum of 15% of the price of the delayed/undelivered goods, in addition to the recovery of interest at normal cash credit rate plus 2% for the unadjusted portion of the advances. If the delay in delivery of a part contributes to delay in execution of total system, LD and interest on advances will be recovered on the total contract price/total advance paid"