

COAL TO 2000 TPD AMMONIUM NITRATE PROJECT OF M/S BCGCL AT LAKHANPUR (ODISHA) INDIA

TECHNICAL SPECIFICATION FOR FUEL OIL AND TANK PACKAGE

SPECIFICATION NO.: PE-TS-544-166-002-A001



BHARAT HEAVY ELECTRICALS LTD

**POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA**

	TECHNICAL SPECIFICATION FOR FUEL OIL AND TANK PACKAGE 2000 TPD BCGCL COAL TO AMMONIUM NITRATE PROJECT LAKHANPUR, ODISHA- LSTK-1 INDEX	SPECIFICATION NO. PE-TS-544-166-002-A001
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TECHNICAL SPECIFICATION FOR FUEL OIL

AND TANK PACKAGE

2000 TPD BCGCL COAL TO AMMONIUM NITRATE

PROJECT LAKHANPUR, ODISHA- LSTK-1

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**COAL TO 2000 TPD AMMONIUM NITRATE PROJECT OF M/S BCGCL AT
LAKHANPUR (ODISHA) INDIA**

**TECHNICAL SPECIFICATION
FOR
FUEL OIL AND TANK PACKAGE**

SECTION - I

SPECIFIC TECHNICAL REQUIREMENT



**BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA**



TECHNICAL SPECIFICATION FOR FUEL OIL AND TANK PACKAGE

COAL TO 2000 TPD AMMONIUM NITRATE PROJECT OF M/S BCGCL AT LAKHANPUR (ODISHA) INDIA

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1.0 INTENT OF SPECIFICATION

- 1.1 The specification is intended to cover design, engineering, manufacture, inspection and testing at vendor's/ sub-vendor's works, painting, forwarding, proper packing and shipment and delivery at site, unloading, handling & transportation at site , Erection & Commissioning including commissioning spares(if applicable), mandatory spares, minor civil works as required on FOR site basis, functional guarantee testing and handing over of **FUEL OIL AND TANK PACKAGE (FOHS AND MISC TANK)** as per details in different sections / volumes of this specification for **COAL TO 2000 TPD AMMONIUM NITRATE PROJECT OF M/S BCGCL AT LAKHANPUR (ODISHA) INDIA**
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor, of the responsibility of providing such facilities to complete the supply, erection and commissioning of FUEL OIL AND TANK PACKAGE.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information , ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification **within 10 days of receipt of tender documents**. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.



**TECHNICAL SPECIFICATION FOR FUEL OIL AND TANK
PACKAGE**

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- 1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.
- 1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or end customer including their consultant as interpreted by BHEL in the relevant context.

COAL TO 2000 TPD AMMONIUM NITRATE PROJECT OF M/S BCGCL AT LAKHANPUR (ODISHA) INDIA

FUEL OIL AND TANK PACKAGE

PROJECT INFORMATION

2. LOCATION AND BRIEF DESCRIPTION OF THE SITE

The proposed site for AMMONIUM NITRATE PLANT is in the vicinity of Mahanadi Coal Field, Lakhanpur. The project site is on coal bearing area and of open cast mining. It's a **pre-project activity for high ash coal-to-ammonium nitrate plant based on indigenously developed coal gasification technology**. This specification deals with the topographical survey works of the proposed plant area and preparation of Survey Report required for design & construction of the proposed project. Bharat Coal Gasification & Chemicals Limited (BCGCL), a joint venture company of CIL and BHEL have entered into an agreement for setting up India's first commercial-scale Coal to ammonium nitrate plant through surface coal gasification (SCG) technology route the gasification plant will be based on developed coal gasification technology by BHEL, which utilised the high ash coal from Lakhanpur Area to produce 0.66 million metric tons per annum (MMTPA) of technical grade ammonium nitrate. A land of around 350 acre is readily available with the CIL and off-take of final product Ammonium Nitrate will be taken by CIL and will be used in explosive activity for mining of coal. This will be the first commercial Coal gasification plant that showcase the indigenously developed coal gasification technology developed by BHEL.

The latitude and longitude of project site area- 21.71811°N and 83.83961° respectively.

The site is located at about 16 kms from Belpahar town and 16.6 km from NH49 (Jharsuguda- Raigarh Road). Further, project site is located at about 36 km. from District headquarter Jharsuguda, located on NH 49. The nearest National Highway is NH-49, at about 16.6 km from the site. The nearest airport is Jharsuguda Airport, at about 37 km from the site. The site has access to the MCL, Lakhanpur through motorable village roads. The nearest rail head, Belpahar, on Jharsuguda-Raigarh Broad-Gauge (BG) Section of the South Eastern Railways is about 16 km at Belpahar town.

Most of the surveyed area is almost plain with some open area, road, drain, culvert, Laboratory, Houses, defunct railway line, Temple, cultivated land, trees etc. Southern part of the land parcel is close to the Hirakud Reservoir and is of Marshy land. The details are shown in the Topographical Drawing. We have found nos of Brick Factory in this area. Mostly developed ponds are due to Brick Factory. Ground level of the surveyed area is ranging from 208m to 228m from MSL.

HFL:

As per information gathered and following topography all around, the area is found to be a flood free upland. Hence no HFL information or marking was available in the surveyed area. Hirakud dam has the reservoir near to this site and its HFL is 190.5m (RL).

RAINFALL INTENSITY , AMBIENT PARAMETERS

Located at an elevation of 233.57 meters (766.31 feet) above sea level, Belpahar has a Tropical wet and dry or savanna climate (Classification: Aw). The district's yearly temperature is 30.41°C (86.74°F) and it is 4.44% higher than India's averages. Belpahar typically receives about 156.07 millimeters (6.14 inches) of precipitation and has 121.01 rainy days (33.15% of the time) annually.

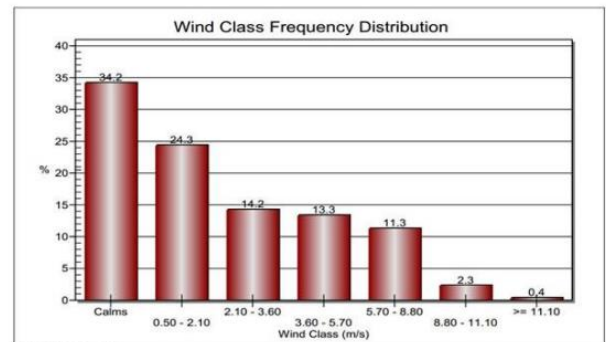
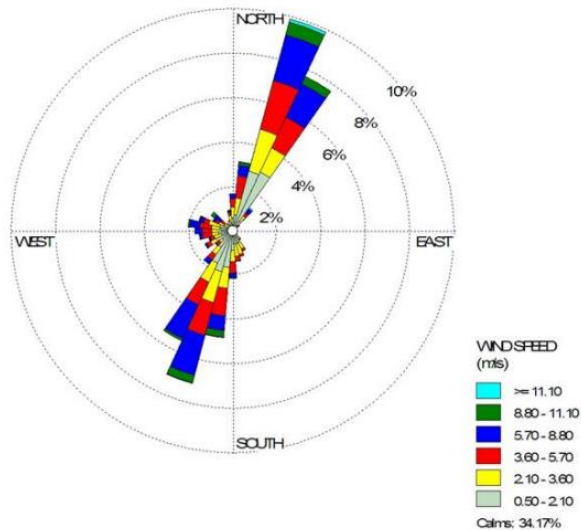
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F) (AMBIENT TEMPERATURE)	35.0 (95.0)	40.0 (104.0)	46.0 (114.8)	51.0 (123.8)	52.0 (125.6)	49.0 (120.2)	41.0 (105.8)	38.0 (100.4)	38.0 (100.4)	37.0 (98.6)	34.0 (93.2)	33.0 (91.4)	52.0 (125.6)
Average high °C (°F) (AMBIENT TEMPERATURE)	28.49 (83.28)	32.68 (90.82)	37.25 (99.05)	41.65 (106.97)	43.45 (110.21)	38.91 (102.04)	33.15 (91.67)	32.19 (89.94)	32.57 (90.63)	32.21 (89.98)	30.62 (87.12)	28.07 (82.53)	34.27 (93.69)
Daily mean °C (°F) (AMBIENT TEMPERATURE)	23.38 (74.08)	27.68 (81.82)	32.74 (90.93)	37.37 (99.27)	39.42 (102.96)	35.82 (96.48)	30.78 (87.4)	29.75 (85.55)	29.82 (85.68)	28.65 (83.57)	26.28 (79.3)	23.27 (73.89)	30.41 (86.74)
Average low °C (°F) (AMBIENT TEMPERATURE)	14.93 (58.87)	17.94 (64.29)	21.7 (71.06)	25.87 (78.57)	28.84 (83.91)	28.93 (84.07)	26.37 (79.47)	25.34 (77.61)	24.75 (76.55)	22.33 (72.19)	18.62 (65.52)	15.45 (59.81)	22.59 (72.66)
Record low °C (°F) (AMBIENT TEMPERATURE)	10.0 (50.0)	13.0 (55.4)	16.0 (60.8)	19.0 (66.2)	21.0 (69.8)	22.0 (71.6)	22.0 (71.6)	20.0 (68.0)	21.0 (69.8)	16.0 (60.8)	13.0 (55.4)	9.0 (48.2)	9.0 (48.2)
Average precipitation mm (inches)	10.32 (0.41)	11.49 (0.45)	10.05 (0.4)	15.48 (0.61)	18.9 (0.74)	218.57 (8.61)	542.07 (21.34)	520.72 (20.5)	388.32 (15.29)	114.16 (4.49)	6.45 (0.25)	16.32 (0.64)	156.07 (6.14)
Average precipitation days (≥ 1.0 mm)	2.09	2.27	2.36	3.64	3.82	17.55	27.91	26.82	21.45	10.64	0.91	1.55	10.08
Average relative humidity (%)	45.06	37.99	28.96	27.02	31.29	49.88	72.33	77.74	75.55	65.27	53.52	50.09	51.23
Mean monthly sunshine hours	8.58	8.6	11.62	12.73	13.06	12.85	11.75	11.67	11.04	11.04	9.01	8.57	10.88

Maximum Relative Humidity = 86 %

METEOROLOGICAL ANALYSIS OF THE AREA

Meteorological data was collected from the nearby weather station. These parameters are essential for input in the AERMET module of AERMOD. From the input two type of files were generated, one is the wind rose diagram for the year and other was AERMET file which was used as an input file in the AERMOD. Cloud Cover (tenths), Dry Bulb Temp (°C), Relative Humidity (%), Station Pressure (mbar), Wind Direction (deg), Wind Speed (m s⁻¹), Ceiling Height (m), Hourly Precipitation (1/100th of inch), Global Horizontal Radiation (Wh m⁻³) were taken as meteorological parameter for the study. The direction suggests the direction from which the wind blows. Figure below shows the Wind rose diagram for the data with 36 directions. Wind frequency

classification was also plotted. It shows percentage of wind with a different speed range. It also shows the time for which calm situation prevailed. The calm state prevailed for 34.17%. The average wind speed for the whole year was found to be 2.33 m s^{-1} . The predominant wind direction was North-Easterly to South-Westerly.



ATTACHMENT-A

Parameters	Temperature	Remarks
Dry Bulb (Summer)	Max. - 45 °C Min. - 19.9 °C	
Dry Bulb (Winter)	Max. - 35 °C Min. - 8.4 °C	
Wet Bulb Temperature	27.5 °C	

Rainfall	Value	Remark
Design rainfall (per hour)	421.7mm	

Relative Humidity	RH %	Remark
Relative Humidity, Minimum	40	
Relative Humidity, Maximum	86	
Relative Humidity, Average	74	

SITE SPECIFIC DESIGN PARAMETERS -WIND LOAD

-

The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows:

-

- a) The basic wind speed “Vb” at ten metres above the mean ground level : 44 metres/second
- b) The risk coefficient “K1” : 1.08
- c) Category of terrain : Category-2

-

SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT

-

As per IS-1893 - Seismic Load (Zone - III)

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**TECHNICAL SPECIFICATION
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FUEL OIL AND TANK PACKAGE**

SECTION I-A

(SPECIFIC TECHNICAL REQUIREMENT-MECHANICAL)

SCOPE OF WORKS, EXCLUSIONS AND TERMINAL POINTS



**BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA**

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A. SCOPE OF WORKS, EXCLUSIONS AND TERMINAL POINTS FOR FUEL OIL HANDLING SYSTEM

1.0.0 SCOPE OF WORK

Design, engineering, manufacture, inspection and testing at vendor's/ sub-vendor's works, painting, forwarding, proper packing, shipment and delivery at site, unloading, handling & transportation at site, Erection & Commissioning, minor civil works as required, functional guarantee, testing and handing over of Fuel Oil System shall be as per details in different sections of this specification.

1.1.0 SCOPE OF SUPPLY

Scope of supply by bidder shall comprise of but not necessarily be limited to the following. P&I Diagrams given with this specification may pls be referred.

- a) **Two (2) nos.** of vertical cylindrical, fixed roof type LDO storage tanks each of net **capacity 200 cum** fully fitted with appurtenances, accessories, instrumentation, controls and fittings etc.
- b) **Three (3) nos** twin screw LDO unloading pump motor set of **capacity 25 m3/hr** each with matching duplex strainers (1 No. for each pump) at their suction.
- c) **Two (2) numbers** vertical single screw pumps motor set with all accessories of capacity **5m3/hr** to transfer **recovered oil** from Oil water separator's (OWS) oil pit located near tank farm area to Drain Oil Tank.
- d) **Four (4) nos.** LDO unloading flexible neoprene hoses of size 80 NB with minimum length as 8.0m. Each hose shall be to suit the layout in unloading area.
- e) **Complete Piping & fittings, Valves, flanges**, fasteners, gaskets, structural supports, pipe trestle within dyke and pump house as required within the terminal point.
- f) Nozzle for foam pourer, heat detector on tank roof & pad plates welded to the tanks as per details to be furnished to the successful bidder during detailed engineering for welding supports for water piping and hydrant piping.
- g) Platform and approach ladder to the platform for foam pourer nozzle.
- h) Sump pumps (1W+1S) where ever required due to layout constraints with in terminal point. Type and capacity of these pumps will be decided during detailed engineering stage without and commercial implication.
- i) All mechanical items for oil water separator pit including skimmer pipe, butterfly valve, heating arrangement (if applicable), rung ladder etc. for OWS.
- j) Buried MS pipes as required along with their wrapping and coating as required.
- k) Pipe-supporting structures over the insert plates for pedestal supported pipes and also on pipe rack supported pipe.
- l) All MS structures for cross overs, valve / instruments/ equipment operating & maintenance platforms, approach ladders for access to platforms, trench/pit.
- m) Painting of equipment along with their accessories within battery limit.
- n) Electrical scope as per enclosure elsewhere in the specification.

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- o) Instrumentation & control System including control panel, instruments, interlocking & protection devices complete in all respects required for safe, efficient and reliable operation of the plant and to be read in conjunction with C&I portion of specification.
- p) C&I Scope as per enclosure elsewhere in the specification.
- q) Erection & commissioning spares as required for the complete system.
- r) One set of special maintenance tools & tackles, if any. These tools shall not be used for erection/ commissioning purposes and shall be in an unused and new condition when they are handed over to the customer at site. Each tool shall be stamped so as to be identified easily for its use. The tools shall be supplied in a steel toolbox.
- s) **Mandatory spares** as per **Annexure-VIII** under specification.
- t) Initial charge of all lubricants and fluids except LDO
- u) All valves, counter- flange with nuts, bolts and gaskets at all the terminal points.
- v) All equipment Foundation bolts/ Anchor bolts etc.
- w) Flowable non- shrink grout of one grade higher than concrete used for civil work grouting below base plate for all structure/ equipment/Tank & for grouting of foundation / anchor bolts.
- x) Relevant scope of supply as per GTR, GCC & SCC.
- y) Valves in pit outside dyke as required as per latest OISD recommendation complying with requirement whichever is more stringent.
- z) Any changes required to take care of temperature effect to be considered by bidder as part of total cost quoted.
- aa) Any other instrument, item required for making the installation complete in all respect and for satisfactory operation of the system for the scope within the terminal point, as well as to meet any statutory requirement relevant to the package, unless specifically EXCLUDED from scope of supply.

1.2.0 SCOPE OF SERVICES

Scope of services by bidder will include but not necessarily limited to the following:

- a) Unloading, Storage, handling and transportation at site.
- b) Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment , grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation itself, excavation & filling of earth for buried MS pipes if and as required. To the extent possible, vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation.
- c) Pre- Commissioning work such as flushing, hydraulic testing etc. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.
- d) Erection & Commissioning of Fuel Oil System.
- e) Erection of all foundation bolts/ anchor bolts etc. as required for any equipment. In case these are not erected when foundation is being cast refer point no b above.
- f) Inspection & testing, Performance Requirements and functional guarantees.
- g) Painting of tank and all other items within scope of supply.

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- h) Making Good/Repairing/replacement of and damaged done by bidder to adjacent structure, pipes etc. while erecting equipment's related to Fuel Oil system.
- i) Electrical scope as per enclosure elsewhere in the specification
- j) Preparation of drawing showing common facilities, if any, between BHEL & Vendor supplied equipment.
- k) Preparation of civil assignment drawings i.e. pedestals details; insert plates / embedment's plates required for supporting pipes and equipment etc. and review of civil drawing prepared by customer based on civil assignment drawing of bidder. In case any modification is required in the civil work already done based on civil inputs given by vendor, rework shall be done at the cost and risk of the vendor.
- l) Preparation of all drawings as per MDL given under specification.

- m) Preparation of all necessary drawings/data/ documents for obtaining necessary Approval of statutory authorities like CCOE , IBR , Weight & Measures Department and any other agency/ competent authority related to installation of Fuel Oil Handling System on behalf of the customer. All expenses required to obtain the approval shall also be borne by the successful bidder. Successful bidder shall inform customer well in advance requirement of authority letter along with format for the same. After issuance of authority letter by customer, it will be vendor's responsibility to regularly follow up with the concerned authorities to obtain timely approval from these authorities. Any delay on account of the same, unless any specific information related to above approval to be furnished by customer is delayed by customer, shall be to vendor's account and shall not be used as a reason for extension in contract completion.

Layout drawing to be prepared for statutory approval apart from showing the technical requirements shall necessarily show key plan showing approach to site with mile stone, Survey No., Khasra No, Plot No. etc.

- n) Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
- o) Relevant requirements as per GTR, GCC, ECC & SCC.
- p) Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system as well as to meet any statutory requirement relevant to the package, unless specifically EXCLUDED from scope of services.

2.0.0 EXCLUSION

a) Civil work for fuel oil unloading & storage system including

- i) Road tanker unloading platform
- ii) Tanks & Pumps foundations
- iii) Unloading Pump House building
- iv) Dyke walls and barbed fencing
- v) Encasing of buried pipes, providing culvert for the same, if required.
- vi) Hume Pipes, if any
- vii) Civil works like pits, wherever required.
- viii) Handrails other than those on the storage tanks.



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- ix) Various cable & pipe trenches, pipe pedestals, drains, sumps, insert plates for pedestals for pipe supports.
- x) Pipe rack/trestle outside pump house and dyke area.

However, location, sizing and loads, top of concrete elevations, top of grout elevations etc. and any other input related to above as applicable, shall be given by the vendor.

- b) Fire Protection system for fuel oil storage tanks.
- c) Air Conditioning / ventilation of Fuel Oil pump house.
- d) Control/IO panel for Fuel Oil pump house.
- e) Lifting equipment for unloading pump house for maintenance purpose of these pumps. Capacity of lifting equipment is envisaged as **2.0 T with lift as 10.0 m**. Bidder to confirm adequacy of the same.
- f) DCS control. However, all logic for implementation of control and monitoring from DCS shall be provided by successful bidder during detail engineering.
- g) Exclusion as indicated in Electrical and C&I portion of technical specification
- h) Relevant exclusion as per GTR, GCC, SCC & ECC.

3.0.0 SERVICES TO BE PROVIDED BY THE CUSTOMER

- a) Relevant services as per GCC, SCC & ECC.

4.0.0 TERMINAL POINT

LDO : Near oil unloading area:

LDO Road Tanker nozzle connection towards LDO Unloading header.

Near Fuel Oil Unloading & Pressurizing Pump House:

Up to 500 mm outside Pump house wall for suction & return line of LDO. Further routing shall be in BHEL-TRICHY scope.

Drain from dyke area : To OWS during normal condition & to plant drain during rainy season through two-way valve pit. Valves in the valve pit along with limit switch for the same are included in bidder's scope.

Change in location of terminal points by up to 50 meters in plan view and 10 m in elevation view shall have no price implication. Isolation valves at the terminal points shall be in the scope of the bidder.

5.0.0 PERFORMANCE REQUIREMENTS

This will comprise of:

5.0.1 PERFORMANCE requirement at shop:

- a. The following parameters shall be demonstrated/guaranteed:

S.N.	Unloading period (hours)	Cap (m3/hr)	Head (mWC)	Power (Kw)
i	LDO unloading pumps	25	By bidder	By bidder

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- b. Noise & vibration level of all pumps in isolation.
- c. Noise level for safety valve to be limited to 105 dB (A)
- d. Inspection and testing of all valves as per approved QAP.

5.0.2 Functional Guarantees(PG) at site:

- a. All pumps shall be guaranteed for capacity, total dynamic head either in isolation or during parallel operation. The capacity of pumps while operating in parallel will be verified by indication in tank level difference.
- b. Each storage tank shall be guaranteed for capacity and stability.
- c. Noise level for safety valve to be limited to 105 dBa
- d. Entire piping & support for smooth operation
- e. All consumable and instruments required during PG Test will be arranged by the bidder. Instruments will be duly calibrated from customer authorized/ approved laboratory. Instruments for PG test and instruments for process control of similar applications are envisaged to be of same make and model having same accuracy level. However, instruments for PG test are also acceptable as per standard and proven practice of the contractor/OEM. **Instruments to be used for PG test shall be additionally supplied over and above the instruments shown in tender P&ID. PG test instruments being used, shall be retained by employer after completion of PG test.**
- f. All other machines / components / system shall be acoustically designed for a surface sound pressure level of $L_p < 85$ dB (A), measured in accordance with ISO 3746 / IEC 651 / BS: 5969 / IS:9779 respectively at a distance of 1.0 m from equipment surface and at a height of 1.5m above ground level. The surface sound pressure level (L_p) shall be averaged over the measurement surface and corrected for effect of background noise and the influence of reflected sound at measurement surface (environmental correction). With sound pressure levels of 85 dB (A) or less according ISO it shall be ensured that maximum surface noise levels of any item of plant of less than 85 dB (A) at 1.0 m from outline and a height of 1.5m from the floor shall be met during normal operating conditions.
- g. In case during test it is found that the equipment/system has failed to meet the guarantees, the contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer. However, if the contractor is not able to demonstrate the guarantees, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by BHEL, after the tests have been completed, BHEL will have the right to Reject the equipment / system / plant and recover the payments already made or accept the equipment / system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by BHEL.
- h. The successful bidder will prepare a document titled "HANDLING OVER PROTOCOL" consisting various activities to be demonstrated by them for handing over of the package.

6.0.0 LAYOUT REQUIREMENTS

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- a) System layout shall conform to the requirements of the Petroleum Act 1934 & Petroleum Rules 2002, OISD 118 latest edition whichever is more stringent. The layout shall also confirm to all other relevant OISD specifications
- b) All established engineering practices with regard to layout of various equipment & piping shall be followed and the same shall be subject to customer approval during detail engineering without any commercial implication.
- c) **Piping inside Fuel oil pump house shall be supported using plate and anchor fasteners, no pedestals will be allowed inside Fuel oil pump house.**
- d) Tentative Location of items related to Fuel Oil Handling System is shown in enclosed **PLOT PLANS**. This will be finalized during detail engineering based on equipment dimensions and other layout related requirements. There will however be no cost implication on account of the same.
- e) To the extent possible, all valves shall be located at grade level for easy operation & maintenance. Where location at grade level is not possible, suitable operating and maintenance platform made of MS grating and access ladder/ staircase/walkways to the same shall be given by the bidder. The platform and walkways will be designed by considering load of at least 750Kg/M2.
- f) Where pipes are routed in a manner that it hampers man movement in any area, suitable no. of cross overs made of MS gratings shall be given across such pipes to facilitate easy man movement. Further suitable access ladder of MS construction shall be given for access to equipment/ pipes located in pit/ trench. Such structures shall be designed by considering a load of at least 750Kg/M2.
- g) For all pedestal supported pipes, BHEL scope will be limited to pedestal with insert plates. Maximum height of pedestal to be provided by BHEL shall be 100 mm from FGL/FFL in the corresponding area. Structures required above these pedestals for supporting the pipes are included in the scope of the bidder.
- h) Layout shall be prepared in a way to avoid the buried piping to the maximum possible extent.
- i) Oily water collected in storage tank area, oil unloading area will normally be collected in OWS pit by gravity either through trench (limited to a depth of 0.5 m) or through buried pipe (limited to a depth of 1.0 m) . However, in case depth of pipe between the pit and OWS pit exceeds 1 m or gravity flow is not possible due to layout constraints (which can be reviewed during detail engineering), the oily water waste shall be collected by pumping to OWS pit. Necessary pumps, valves, pipes, pipe supports, and instruments etc. for the same shall be in the bidder's scope.
- j) Straight length required before and after control valve s, flow element/ flow meters, shall be provided as per latest standard/ applicable codes.
- k) Rainwater collected inside the dyke shall be diverted to storm water drain while contaminated oily waste shall be sent to OWS. All valves required in pits outside the dyke are included in bidder's scope of supply.
- l) Instruments to be mounted on tank shall be suitably located so as to have easy access from the staircase without interfering with man movement on the staircase. Wherever this is not possible, suitable platform along with access to the same shall be provided by FO System bidder.

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- m) Signals from all field instruments shall be first terminated in Junction boxes before transmitting this signal either to Control panel or to I/O rack or to DCS. Junction box is included in bidder's scope. Erection of cable between field instruments to Junction Box is also included in bidder's scope. Scope of cable supply shall be as per project specific scope split sheet given under electrical portion of this specification.
- n) All piping shall be arranged to provide clearance for removal of equipment requiring maintenance and easy access to valve and other piping accessories required for operation and maintenance. The layout drawing to be submitted by the successful bidder will necessarily show the valve orientation and access to valve and accessories.
- o) Instrument/ LIE/LIR shall not be located in space meant for walkway & maintenance space across the equipment, maintenance bay of building. Location of all instruments shall be marked in layout drawing to ensure correct location of the same.

7.0.0 EQUIPMENT SELECTION & DESIGN CRITERIA

The minimum design criteria/ technical details to be followed for various equipment shall be as per Data Sheets / Design criteria under **Annexure – II** of specification. Any contradictory requirement for specification of particular equipment, and clarifications not having been sought by the bidders, the most stringent requirement as per interpretation of the BHEL will prevail. Successful bidder will furnish detailed data sheets/ specifications / design calculations for various equipment for customer's/ consultant's approval during detail engineering. For items for which specific technical specification is not enclosed, data sheet / dwgs / design calculations for such items shall be subject to customer/ consultant approval during detail engineering. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

8.0.0 SYSTEM WRITE UP & CONTROL

For system write up and control requirement of fuel oil unloading and storage system, pls refer separate **Annexure-I** under specification.

9.0.0 PAINTING / CORROSION PROTECTION REQUIREMENT

During detailed engineering stage, successful bidder shall prepare and submit the painting schedule for FOHS in line with customer specification for each equipment pipe, tanks, structure etc. for customer approval and changes suggested shall be taken care without any commercial implication.

10.0.0 QUALITY ASSURANCE, QUALITY PLANS, INSPECTION & TESTING PROCEDURE:

- a) The Quality plans / checklist for the previous executed jobs for the equipment's / instruments are given under specification.
- b) The successful bidder shall furnish Quality Plans/ Inspection Check Lists for various item for the package in line with minimum requirement indicated in specification during detail engineering for Customer's approval.
- c) For other items for which any specific inspection requirement is not indicated in the specification but the same included in scope of work , vendor specific QPs/ CLs shall be furnished by the successful bidder for Customer/Consultant's review and approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

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- d) The Field Quality Plan of bidder shall also be submitted by the successful bidder during detail engineering for customer's / consultant's approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.
- e) For flame proof actuator, motors, junction boxes, instruments etc. as per specification requirement, valid test certificate for the same shall be submitted by the vendor as part of QC documentation. In case valid test certificates are not available, necessary test shall be conducted in line with applicable standard in presence of customer and cost of such test shall be deemed to be included in the contract price

11.0.0 SUB-VENDOR ITEMS

The tentative make of Sub-vendor items is given under **Annexure– IV**, same shall be subject to customer approval during detail engineering. Make of any unlisted items shall be subject to customer approval during detail engineering. For such items, bidder to furnish list of sub-vendors during detail engineering stage for BHEL's review and approval. Bidder shall furnish along with his offer the following supporting documentation within 1 month of placement of LOI. Thereafter no request for additional sub-vendor shall be entertained.

- Documentation to show that the equipment /system have been supplied for a plant of similar or higher capacity.
- Documentation in the form of certificate that the equipment/system has been **operating satisfactorily for one year as on the scheduled date of bid opening.**

The successful bidder will get the makes of all items approved from Customer/ Consultant during detail engineering within two months of placement of LOI. The complete list will be necessarily be submitted within one month of placement of LOI to ensure timely placement of order for BOIs.

Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

12.0.0 DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH THE BID

The drawings and documents to be submitted with the bid shall strictly be as per list given under specification. Any documents other than those indicated in the list will not be reviewed and will not form part of contract.

13.0.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

Tentative list of drawing / document required during detail engineering is attached in **Annexure – V**. Any other drawings and documents as required by BHEL / Customer / Consultant shall be furnished by the successful bidder during detail engineering stage for which no commercial implication shall be entertained by BHEL.

14.0.0 DRAWINGS DISTRIBUTION SCHEDULE

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Vendor needs to submit 5 nos. hard copies of each drawing/document during detail engineering along with editable soft copy of the same. However, exact no. of drawings / documents and submission/distribution procedure for the same shall be intimated to the successful bidder after award of contract and the same shall be complied by the successful bidder without any commercial implication.

15.0.0 DRAWINGS ENCLOSED WITH THE SPECIFICATION

Input drawings for this package are given under **Annexure-VI** namely:

- Plot plan, **PE-DG-544-100-M001**
- Process & Instrumentation Diagram for FOHS (LDO System), **PE-DG-544-166-A001**
- GA and Nozzle Orientation of LDO Storage Tanks, **PE-V0-544-166-A021**
- Tentative Layout of Composite Fuel Oil Area, **PE-V0-544-166-A018**
- GA drawing of Fuel Oil Pump House, **PE-DG-544-166-A025**

The flow diagrams are indicative and show the minimum requirement to be followed including minimum requirement of instruments. Any other item and instruments required (within the terminal points) to make the system complete in all respect and for satisfactory operation of the system shall also deemed to have been included by the bidder in their scope.

16.0.0 OTHER REQUIREMENTS

i) Site Visit before submission of offer.

Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details wrt existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

ii) Bidder shall submit detail erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

iii) The O&M Manual to be submitted by the successful bidder should necessarily address "Checklist of O&M Manual" given under SECTION-II.B.

iv) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

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v) In case vendor submits revised drawing/doc after approval of the corresponding drawing/doc, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at customer end, delay in review/ approval of such revised drawing beyond one month will be to customer's account.

vi) Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web-based Document Management System in addition to hard copies to be submitted as per dwg/ document distribution schedule. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized after award of contract. Bidder to ensure following at their end

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's Internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>)

DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.

For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

vii) Engineering for this project is being carried out in 3D environment at BHEL end. Name of engineering platform on which BHEL is doing the project is E3D. This is being done to have automated interface checking and thereby minimising rework at site.

viii) Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.

ix) Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".

xi) Site storage and preservation manual has been placed under **SECTION-IIC**. Bidder to note down all the requirement of storage and preservation required for several items given under this manual. Bidder shall necessarily follow all the practices given in the manual as applicable for its items/ equipments under scope of supply.

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B. SCOPE OF WORKS, EXCLUSIONS AND TERMINAL POINTS FOR MISC. TANKS

1.0 SCOPE OF SUPPLY

- 1.1 The CST shall be designed, fabricated, supplied and erected at site and the surge tanks shall be designed, fabricated, supplied, erected and commissioned, in accordance with their respective Data Sheets and approved GA drawings. The CST shall be site-fabricated, **whereas the surge tanks shall be manufactured and tested in accordance with ASME Section VIII, Division 1** and erected/assembled at site as required. Modifications may be proposed by the bidder to suit good engineering practice and applicable design-code requirements, subject to approval of the customer. The customer reserves the right to reject any modification.
- 1.2
- The connections and accessories to be supplied with each CST and each surge tank shall be as indicated in their respective Data Sheets and approved GA drawings.
 - The piping material inside the tank shall be supplied by the bidder. All inlet piping shall be extended up to the bottom of the tank and the clearance between the bottom of the tank and the edge of the inlet piping shall be kept as 500 mm (maximum).
 - For the CST, the inside piping shall be adequately supported and shall be provided with adequately sized vent connection at pipe top.
 - For the CST, weir plates of adequate thickness (minimum 8 mm) shall be provided for all inlet piping.
 - Pad plates on the CST and surge tanks for supporting outside piping shall be provided by the bidder. Details of pad plates, including sizes and quantities, shall be finalised during detailed engineering. For surge tanks, the pad plates and associated vessel-shell stresses shall comply with ASME Section VIII, Division 1.
 - Fabrication and supply of all flanges and counter flanges for all nozzles and valves of the CST and surge tanks shall be included in the bidder's scope. Necessary bolts, nuts and gaskets for these connections shall also be supplied by the bidder. Surge-tank flanges, bolting and gaskets shall be suitable for the specified design pressure and temperature and shall conform to the applicable pressure-vessel/piping class.
 - The CST manhole shall be of hinged and bolted type and shall be minimum 600 mm, complete with nuts, bolts and gasket in the bidder's scope. Each surge-tank manhole shall be bolted type, minimum 600 NB as indicated in the surge-tank requirement, and shall be supplied complete with cover-handling arrangement, nuts/studs, bolts and gasket in the bidder's scope.
- 1.3 The bidder's scope shall include supply and installation of special accessories indicated in the respective Data Sheets and approved GA drawings of the CST and surge tanks. Necessary fixtures and other accessories required for mounting these special fittings shall also be included in the bidder's scope.

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1.4	Level gauge / indicator shall be provided by the bidder along with all fittings & accessories as required for mounting the level gauge / indicator on the tanks. Float and board type level gauge / indicator shall be provided unless otherwise specified in DATA SHEET-A and GA drawing for Miscellaneous tanks.		
1.5	For the CST, the required number of tappings with 25 NB instrument root valves shall be provided for mounting level switches, level transmitters and other instruments, as indicated in the CST Data Sheet and approved GA drawing. For each surge tank, instrument connections shall be provided as indicated in the surge-tank Data Sheet and approved GA drawing, including two 50 NB pressure-transmitter connections, one 50 NB pressure-gauge connection, one 40 NB temperature-element connection and one M33 temperature-gauge connection.		
1.6			
a)	Sampling Connection with isolation valve of size 25 NB for CST (if indicated in DATA SHEET-A and GA drawing for Miscellaneous tanks).		
b)	A 100 NB drain valve shall be provided for the CST unless otherwise indicated in the CST Data Sheet and approved GA drawing. Each surge tank shall be provided with one 50 NB drain connection (N10), complete with the required isolation valve, counter flange, bolting and gasket, unless otherwise indicated in the approved surge-tank documents.		
c)	Quantity and size of spare nozzles and valves shall be supplied by the bidder as per DATA SHEET-A and GA drawing for CST.		
1.7	For the CST, NaOH / KOH breather and seal pot shall be provided with necessary drain valve of size 25 NB with stainless steel construction unless otherwise specified in the DATA SHEET-A and GA drawing for Miscellaneous tanks. Two (2) nos. NaOH / KOH breather shall be provided by the bidder for each tank out of which one shall be used for in-breathing purpose and the other shall be used for out-breathing purpose.		
1.8	Pipes, fittings, nozzles, flanges and counter flanges for the CST and surge tanks shall be supplied by the bidder. Minimum quantities, sizes, types and materials shall be as indicated in the respective Data Sheets and approved GA drawings and shall be finalised during detailed engineering. The bidder shall supply them in accordance with the approved drawings/documents without commercial implication. Surge-tank items shall be compatible with SA 516 Gr.70 vessel construction, CO2/N2 service, design pressure 37.4 kg/cm ² (abs), design temperature 130°C and the applicable ASME pressure class.		
1.9	All CST valves shall be of stainless-steel construction as specified in Section-IB for the Condensate Storage Tank. Supply of all surge-tank valves, including safety relief valves, drain valves, instrument root valves and associated valve fittings, is excluded from the bidder's/surge-tank sub-vendor's scope and shall be under BHEL(Trichy) scope. The bidder/sub-vendor shall provide the required pressure-rated vessel nozzles and mating counter flanges.		
1.10	NaOH / KOH breather and seal pot shall be located in the bottom / ground level and necessary connection from tank vent to NaOH / KOH breather shall be provided through 250 NB SS pipe for condensate storage tank.		
The overflow pipe from overflow nozzle to seal pot shall also be in bidder's scope of work.			
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1.11 For the CST, the minimum number and size of anchor bolts shall be as specified in the applicable CST GA drawing. For each vertical surge tank, the bidder, through its surge-tank sub-vendor, shall determine and design the complete anchor-bolt arrangement together with the skirt, base ring, gussets and foundation interface, based on the tender surge-tank requirements, applicable design codes and all governing operating, hydrotest, wind, seismic, piping, transportation and erection loads. The bidder shall submit the design calculations, foundation loads, anchor-bolt details and surge-tank GA drawing for BHEL/customer approval during detailed engineering. Complete supply and installation of anchor bolts, nuts, washers and templates shall be in the bidder's scope. Any increase in the number, size or grade of anchor bolts required to meet the approved design shall be provided without any commercial implication to BHEL. 1.12 Painting of the CST and surge tanks shall be included in the bidder's scope. The CST, seal pot and NaOH/KOH breathers shall be painted in accordance with the specified painting system. The surge-tank external coating shall be suitable for the installation environment and the specified operating/design temperatures. Any modification to the applicable painting requirement finalised during detailed engineering shall be included without commercial implication. 1.13 Commissioning spares required for commissioning the CST, NaOH/KOH breathers and seal pots shall be in the bidder's scope. For surge tanks, commissioning spares shall be limited to the vessel, supplied nozzles, mating counter flanges, gaskets, bolting, supports and other items actually included in the bidder's package. Spares for instruments, instrument accessories, valves, safety relief valves and associated fittings are excluded and shall be under BHEL(Trichy) scope. 1.14 Platforms, internal monkey ladder, staircase, handrails, knee guards and toe guards for the CST shall be provided as indicated in the CST Data Sheet and approved GA drawing and in accordance with the applicable design code/good engineering practice. For surge tanks, the bidder shall provide the platforms, ladder/stair access, handrails and toe guards required for safe access to the manhole, safety relief valve and instruments, as indicated in the approved GA drawing; an internal monkey ladder shall be provided only if specified. Applicable stair treads and platforms shall be fabricated from minimum 8 mm thick chequered plate. 1.15 Suitable structural items like channels and saddle supports shall be provided for fixing the tank with foundation for each of rectangular tank and horizontal cylindrical tank respectively. 1.16 SURGE-TANK SCOPE : a) The surge tanks shall be sourced from a technically qualified and BHEL/customer-approved pressure-vessel sub-vendor. Notwithstanding such subcontracting, the package bidder shall remain fully responsible for design coordination, procurement, quality, delivery, erection, commissioning, documentation, guarantees and compliance with this specification. b) The bidder/sub-vendor shall prepare the detailed Data Sheet, design calculations and GA/fabrication drawings and obtain BHEL/customer approval during detailed engineering before manufacture. c) The bidder shall develop the surge-tank layout and orientation with reference to the basic scheme, overall plot plan, proposal-stage tank location, piping interfaces, maintenance access and erection requirements. Any height restriction or dimensional constraint shall be coordinated with BHEL and incorporated in the approved GA drawing before manufacture.			

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d) Design, supply and application of light resin-bonded mineral wool insulation with external aluminium cladding for the surge tanks shall be in the bidder’s scope. Insulation thickness shall be designed to limit the outer surface temperature to 60°C at 45°C ambient temperature and 0.25 m/s wind velocity.

e) The surge-tank bidder/sub-vendor's scope is limited to providing the required vessel nozzles/connections and mating counter flanges. All instruments, instrument accessories, valves and associated fittings are under BHEL(Trichy) scope. Interface details and nozzle loads shall be coordinated during detailed engineering.

f) The surge-tank bidder/sub-vendor shall provide the drain nozzle/connection. The drain valve, drain piping and associated drain items are under Trichy scope.

g) All statutory/code approvals required for pressure-vessel design detailing and manufacture shall be in bidder’s scope. The bidder shall furnish all drawings, calculations, certificates and records required by BHEL Trichy for obtaining overall-system approval.

2.0 SCOPE OF SERVICES

Services shall include but not be limited to the followings:

2.1 Design and engineering, preparation of detailed fabrication drawings, bill of materials, tag and piece numbers, welding procedures and all related documents shall be included for the CST and surge tanks. Stiffeners and structural framing/support shall be designed by the fabricator and shown on the fabrication drawings. Surge-tank design calculations and drawings shall comply with ASME Section VIII, Division 1 and shall include shell, heads, nozzles, reinforcement, supports, local loads and lifting/erection provisions.

2.2 Erection and commissioning of the CST and all four surge tanks shall be included.

2.3 Erection and installation of all foundation bolts, anchor bolts, templates and associated fixing items required for the CST, surge tanks, equipment and foundations shall be included.

2.4 Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of pockets, excavation & filling of earth for buried MS pipes if and as required.

2.5 Inspection, testing and demonstration/functional tests of the CST and surge tanks shall be carried out in accordance with the respective approved quality plans, design codes and test procedures.

2.6 Painting/coating of the CST, surge tanks and other equipment within the battery limit.

2.7 Any equipment, material or service required to make the CST and surge-tank installations complete, safe and operable in all respects shall be deemed included in the bidder's scope, whether specifically mentioned or not.

3.0 DESIGN CONSIDERATIONS

3.1 Sizing calculations for the CST NaOH/KOH breathers, seal pot and breather valves shall be furnished by the bidder. Surge-tank safety-relief-valve sizing and valve supply are under BHEL(Trichy) system-engineering scope; however, the bidder/sub-vendor shall provide the correctly sized and reinforced

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relief-valve nozzle and all vessel design information required for relief sizing and shall verify the specified set pressure against the vessel MAWP. 3.2 CST appurtenances and mountings shall be designed to the relevant clauses of IS 803/API 650 and the code specified in the CST Data Sheet. Surge-tank appurtenances and mountings shall be designed for all applicable pressure, dead, operating, piping, wind, seismic, transportation and erection loads in accordance with ASME Section VIII, Division 1 and applicable structural standards 3.3 Tank shall be suitably constructed for safe, proper and continuous operation under all conditions that can be expected in a plant life without undue strain, corrosion or other operating difficulties. 3.4 For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature. 3.5 Vessels seams shall be so positioned that they do not pass though vessel connections. For cylindrical vessels consisting of more than two sections longitudinal seams shall be offset. 3.6 Wherever possible, the inside seam weld shall be ground smooth, suitable for application of corrosion resistant primer. 3.7 For the tanks being of diameter larger than 3.75 m added structural supports in the form of rafter shall be provided. 3.8 Reinforcement of CST openings shall comply with the CST design code, and reinforced connections shall be pre-assembled into the shell plate. Reinforcement of surge-tank nozzles/openings shall comply with ASME Section VIII, Division 1 and shall be incorporated into the pressure boundary under controlled shop fabrication. 3.9 Staircases, access ladders, platforms and handrails for the CST and surge tanks shall be provided in accordance with applicable codes, approved GA drawings and safe-access requirements. 3.10 Code conformance for flanges / counter flanges shall be ANSI B 16.5. Code conformance for bolts and nuts shall be SA 193 & 194 respectively. 3.11 For the CST, the number & size of nozzles (including flanges, counter flanges and inside piping) indicated in the GA drawing attached with the data sheets are tentative and bidder guidance purpose only and the same may undergo change during detail engineering stage for which no commercial implication shall be entertained by BHEL. For surge tanks, minimum connections shall be based on the approved MDL and surge-tank requirement drawing, including N1 to N11 3.12 For the CST, STAAD calculations and roof-structure calculations shall be furnished during detailed engineering. For each surge tank, structural calculations for the skirt, base ring, gussets, anchor bolts, platforms and applicable wind/seismic loads shall be furnished together with the ASME pressure-vessel design calculations. 3.13 For the CST, provision shall be made by the bidder to minimise the air ingress in the tank through float with arrow type level gauge and details of the same shall be furnished during detail engineering stage for BHEL’s approval and approved arrangement shall be provided by the bidder without any commercial implication.			
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3.14 The CST shall be designed for the specified filled-water head/atmospheric pressure and design temperature given in its Data Sheet and GA drawing. Each surge tank shall be designed for 37.4 kg/cm²(abs) and 130°C, with maximum operating pressure 34 kg/cm²(abs) and maximum operating temperature 100°C. Required storage volume shall be 55 m³ for each coal-feed surge tank and 110 m³ for each coal/ash lock-pressurisation surge tank.

3.15 Bidder to note that surface cleaning shall be of Blast clean type. However, Grit blasting shall be decided during detail engineering for which no commercial implication shall be entertained by BHEL.

3.16 All furnished materials shall conform to the latest applicable editions of ASME B31.1, ASME B16.11, ASME Boiler and Pressure Vessel Code, IBR where applicable, and other applicable ASME, ANSI and Indian Standards. Pipe dimensions shall conform to ASME B36.10M for carbon/alloy steel and ASME B36.19M for stainless steel unless otherwise specified. The surge-tank pressure vessel shall specifically comply with ASME Section VIII, Division 1 and shall be constructed from SA 516 Gr.70 with 3 mm corrosion/erosion allowance

4.0 WELDING

4.1 CST welding shall comply with IS 803, IS 816, IS 817 and IS 823 or approved equivalent. Surge-tank pressure-retaining welding shall comply with ASME Section VIII, Division 1 using welding procedures and personnel qualified in accordance with ASME Section IX.

4.2 Welding sequence shall be adopted in such a way so as to minimize the distortion due to welding shrinkage. Contractor shall indicate in his drawing the sequence of welding proposed by him, which should meet prior approval of the Engineer.

4.3 All welders shall be BHEL / customer / consultant qualified as per the approved quality plan / field quality plan which will be submitted by the successful bidder during detail engineering stage. WPS and PQR shall be submitted by the successful bidder to BHEL / customer / consultant for review and approval.

5.0 TEST AND INSPECTION

5.1 The particulars of the proposed tests and the procedure for the tests shall be submitted to the Owner / Engineer for approval before conducting the tests. The successful bidder shall submit FQP (field quality plan) and demonstration test procedure for BHEL / customer / consultant’s approval during detail engineering stage. In the event of any change in the field quality plan and demonstration test procedure, the same shall be incorporated by the bidder in the document and approved document shall be adhered by the bidder without any commercial and delivery implication.

5.2 For the CST, DPT/MPI shall be carried out on all welds (100%) as specified. For surge tanks, 100% visual examination and the applicable PT/MT of pressure-boundary, attachment and repaired areas shall be performed in accordance with ASME Section VIII, the approved NDE plan and acceptance criteria.

5.3 For the CST, all cross/T-joints and butt welds shall be subject to 10% radiography. Surge-tank pressure-boundary butt welds shall be subject to 100% radiography, in accordance with the surge-

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**TECHNICAL SPECIFICATION FOR
FUEL OIL AND TANK PACKAGE**

**COAL TO 2000 TPD AMMONIUM NITRATE PROJECT OF
M/S BCGCL AT LAKHANPUR (ODISHA) INDIA**

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tank requirement and ASME Section VIII, Division 1. NDE personnel shall be suitably qualified and all reports and films/digital images shall be included in the manufacturing record.

- 5.4 The CST shall undergo a water-fill test for at least 24 hours and its internal surface shall be leak tested before painting. Each surge tank shall undergo hydrostatic pressure testing in accordance with ASME Section VIII, Division 1 after completion of pressure-boundary fabrication and NDE; test pressure, holding time, water quality, metal temperature and acceptance criteria shall be stated in the approved procedure. Final pressure-boundary painting shall be applied only after satisfactory completion of testing.
- 5.5 All quality plans / Inspection checklists for various items shall be furnished during detail engineering stage for BHEL / customer's approval and any changes required by BHEL / customer shall be incorporated in the documents and adhered without any price implication. However, minimum requirement of MQP as indicated in the technical specification shall be followed. All necessary items as required for inspection and testing of the tank including instruments shall be arranged by the bidder.
- 5.6 For other items for which any specific inspection requirement is not indicated in the specification but the same included in scope of work, vendor specific QPs/ CLs shall be furnished by the successful bidder for Customer/Consultant's review and approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

6.0 MANDATORY SPARES: NA

7.0 LIST OF COMMISSIONING SPARES:

SL. NO.	DESCRIPTION OF ITEMS	QUANTITY
1	CAF Gasket of size 1.5m X1.5m X 3 mm thick	2 nos.
2	Nuts, bolts & washers of each size (nos. of bolts, nuts & washers as required for each nozzle) as per approved Drg.	1 lot
3	Any other item required for successful commissioning of the tanks (to be specified clearly by bidder)	

8.0 TERMINAL POINTS

- Matching counter flanges for all nozzles mounted on the tank and its accessories. However, counter flanges for all nozzles and valves of tank shall be provided by the bidder.
- Drain pipe of seal pot and NaOH breather pots.

9.0 EXCLUSIONS

- Tank foundation & associated civil works, LTs are excluded from bidder's scope of work.

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10.0 DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH THE BID

The bidder must submit the drawings / documents as mentioned under “CHECK LIST FOR DOCUMENT TO BE SUBMITTED” (In Section-III) along with their bid in 4 sets. In absence of any of these documents, BHEL reserves right not to evaluate the offer of the concerned bidder.

11.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The successful bidder shall submit the drawing / documents as mentioned under SECTION –IA during detail engineering for approval / information / reference (as the case may be): -

12.0 OTHER TECHNICAL REQUIREMENTS

- 1) 15 days' time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.
- 2) Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL.
- 3) Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.
- 4) Commercial implication includes price implication as well as delivery implication.
- 5) Size of hand rails on stairway and tank roof / top shall be minimum 32 NB and shall conform to IS 1239 (M).
- 6) Type of roof for vertical cylindrical storage tanks shall be either supported cone roof or self-supporting cone roof as per latest edition of relevant design code. This clause is not applicable to surge tanks, which shall have ASME-code pressure-vessel heads as shown on the approved GA drawing.
- 7) Commissioning of tanks will consist of installation of all accessories of tanks as per approved drawing/specification, charging of tank, water-fill test (for minimum 24 hours after complete filling of tank), satisfactory functioning of all accessories, emptying of tank, subsequent painting of complete tanks and changing of gaskets as per specification requirement. Surge-tank commissioning under the bidder's scope shall include erection/alignment, installation of supplied vessel accessories, cleaning, inspection of terminal connections, leak/tightness testing with an approved safe medium and coordination during controlled CO₂/N₂ charging and functional demonstration.
- 8) Bidder to furnish prices and unit price of each item of proposed tanks as per BHEL's price format only along with the final price bid.

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- 9) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.
- 10) All tools and plants including welding machines, crane, hydra, fork lift, batching plant etc. and instruments as required for construction, erection and commissioning, trial run and functional demonstration test at site shall be arranged by the bidder.
- 11) Bidder to furnish list of sub-vendors based on sub-vendor list enclosed with the specification during detail engineering stage for BHEL's / Customer review and approval and items shall be procured from these suppliers only.

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ANNEXURE- 7 - 2G

INSULATION WORK

1.0 GENERAL

1.1 SCOPE

This standard covers the requirement for supply and application of materials for thermal insulation of equipment, piping and other items.

1.2 REFERENCE STANDARDS

The design shall be in accordance with established codes, sound engineering practices and shall conform to the statutory regulations applicable to the country. The main codes, standards and statutory regulations considered as minimum requirements are as follows:- (Latest revision of these shall be followed)

IS 14164	Code of Practice for Industrial Application and finishing of thermal insulation material at temperature -80°C and up to 750°C.
IS 737	Wrought aluminum and aluminum alloys, sheet, strip
IS 1254	Specification for corrugated aluminum sheet
IS 1322	Bitumen felts for waterproofing and damp proofing
IS 3069	Glossary of terms, symbols and units relating to thermal insulation materials.
IS 8183	Specifications for bonded mineral wool.
IS 9743	Thermal insulation finishing cements
IS 12436	Specification for Preformed Rigid Poly-urethane (PUF) and Poly-isocyanurate (PIR) Foams for Thermal Insulation
IS 13205	Code of practice for the application of polyurethane insulation by the in-situ pouring method.
ASTM C921	Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
ASTM C1029	Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation
ASTM C1696-16	Standard Guide for Industrial Thermal Insulation Systems
ASTM C411	Standard Test Method for Hot-Surface Performance of High - Temperature Thermal Insulation

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ASTM C450	Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging
ASTM C871	Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions
ASTM C1338	Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
ASTM C1055	Guide for Heated System Surface Conditions that Produce Contact Burn Injuries
ASTM C1139	Specification for Fibrous Glass Thermal Insulation and Sound Absorbing Blanket and Board
ASTM D1622	Test Method for Apparent Density of Rigid Cellular Plastics
ASTM C680	Standard Practice for Heat Loss or Gain and Surface Temp.

1.3

Deviations:

Should unforeseen difficulties arise to comply with requirements of this standard.

Alternative material and application techniques superior to the requirements of this standard be submitted with complete details for approval of owner.

In case of any conflict / deviations amongst various documents, the order of precedence shall be as follows:

1. Statutory regulations.
2. Job specifications.
3. Engineering design basis.
4. Standard specification.

1.4

LIMITATIONS

Temperature Limits.

This standard deals with insulation applied externally on piping equipments etc. as per the table below:-

Maximum Operating Temperature	Type of Insulation
60 ⁰ C to 750 ⁰ C for C.S., A.S. & S.S.	HOT
- 180 ⁰ C to 20 ⁰ C	COLD

1.5

THICKNESS DESIGN BASIS

Thickness calculation method as per procedure given in ASTM C-680

1. Hot Insulation

Design Ambient Temperature : 35⁰C

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Design Surface Temperature	: 45°C
Permissible Heat Loss	: 100 kcal./m ² hr.
Permissible Wind Velocity Outside	: 1 m/sec
Permissible Wind Velocity Inside	: 0.25 m/sec

2. Cold Insulation

Design Ambient Temperature	: 35°C
Design Surface Temperature	: 2 °C below ambient/ 0.5 Deg C above the Dew Point
Permissible Heat Gain	: 10-12 kcal/m ² hr
Relative Humidity	: 85%
Permissible Wind Velocity Outside	: 1 m/sec.
Permissible Wind Velocity Inside	: 0.25 m/sec.

1.6 GENERAL REQUIREMENTS

1.6.1 Information to be supplied

- Material of construction / dimension of equipments / pipes required to be insulated.
- Temperature
- Location of equipment (Indoor/Outdoor/Elevn.)
- Requirement of removable box type insulation if any
- Special requirements if any regarding type of insulation material and other properties.
- These information shall be supplied in form of insulation schedule.
- Design calculations, drawings and insulation material schedule.
- Material Test certificate's.
- Insulation works execution schedule.
- Detailed procedure for all types of execution works.
- Bill of Quantities, Initial material take-off, final material take off and material requisition.
- QA/QC plan.

1.6.2 STORAGE OF MATERIAL

Insulation material shall at no time be stacked directly on the ground; instead it will be stored at a level higher than ground level. It should not only be covered by tarpaulin but other effective protections against weather are also to be provided. The contractor shall provide a properly covered storage to the satisfaction of engineer-in-charge (Refer IS: 10556).

1.6.3 HYDROSTATIC TEST FOR PIPES

Before taking up insulation job on piping or vessels it shall be ensured that hydrostatic test of the concerned equipment / piping is completed. Where it is felt necessary to take up the insulation job before such testing are performed all welded and mechanical joints shall be left un-insulated for a length of at least 150mm on either side of the joint.

1.6.4 PROTECTION OF INCOMPLETE JOBS

Any part of insulation job which is not provided with final weather proofing will be adequately protected by means of tarpaulins and other aids. After the day's work similar protection should be provided for the partially completed jobs to be continued the next day to avoid any absorption of rain / moisture during the night.

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2.0 INSULATION SUPPORTS (CLEATS) TO BE PROVIDED BY EQUIPMENT SUPPLIER

Suitable supports (cleats) in the form of rings, lugs, studs or pins shall be provided on equipment by equipment supplier, however should any additional supports or anchorage be felt necessary for insulation works, the same shall be also considered in LTSK's scope, including all allied work necessary for the same. These will be installed by the contractor free of any extra cost. Owner shall be informed about the same in advance, so also design/drawings shall be updated accordingly.

3.0 MATERIAL REQUIREMENTS

3.1 INSULATION MATERIALS

3.1.1 General

Whenever reference to any Standard is made it is presumed that the latest revision as on date should be considered unless otherwise specified.

3.1.2 Specification and other requirements

Specification and other requirements will be as per below mentioned table:-

Hot Insulation:

For operating temperature Upto 400 deg.C,	Rockwool Mattress of density 120 kg/m3 conforming to IS:8183.
For operating temperature 401-450 deg.C,	Rockwool Mattress of density 150 kg/m3 conforming to IS:8183.
For operating temperature 451-500 deg.C,	1 st layer insulation shall be 25mm Ceramic Fibre Blanket of density 128 kg/m3 conforming to IS :15402 and balance layers with Rockwool Mattress of density 150 kg/m3 conforming to IS:8183.
For operating temperature 501-550 deg.C	1 st layer insulation shall be 50mm Ceramic Fibre Blanket of density 128 kg/m3 conforming to IS :15402 and balance layers with Rockwool Mattress of density 150 kg/m3 conforming to IS:8183.
For operating temperature 551-600 deg.C,	1 st layer insulation shall be 75mm Ceramic Fibre Blanket of density 128 kg/m3 conforming to IS :15402 and balance layers with Rockwool Mattress of density 150 kg/m3 conforming to IS:8183.

Bands/Wires for securing insulation shall be of ASTM 8209 Alloy 3003 H16 or 18-737 designation 31000 (old NS3) condition H3 or 18/8 Stainless steel.

For securing cladding on insulation on piping, aluminium band 12mm (min) X 24 SWG thick shall be used. For securing cladding on insulation on equipment, aluminium band 20mm wide X 24 SWG shall be used.

Other insulating materials may be used provided they have the same or better properties and durability aspects.

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Insulation thickness of insulating materials shall be based on design calculation of thermal conductivity, insulation class, etc. Same shall be submitted to the Owner with necessary design calculations, drawings, test certificates and durability parameters.

For Valves, Turbines & Compressors Insulation

Prefabricated factory made Ceramic Fibre pad to be used made out of Ceramic Fibre Blanket of density 128 kg/m³ encased in high temperature resistant cloth. The minimum thickness of the pad shall be –

- | | | | | |
|----|-----------|----|-----------|--------|
| 1. | 0 Deg.C | to | 300 Deg.C | = 25mm |
| 2. | 301 Deg.C | to | 400 Deg.C | = 50mm |
| 3. | 401 Deg.C | to | 500 Deg.C | = 75mm |

Removable insulation for flanges and valves, like tailor made jackets or pre formed insulation boxes, shall be suitable for quick removal and reinstallation. All tailor made jackets shall fit the actual valve/flange/equipment and secure adequate overlap to incoming insulated pipes.

Technical data sheet of the Ceramic Fibre Pad is as below:

A.	Purpose/Application This Engineering specification is for Fabric jacketed supercera ceramic Fibre insulated flexible reusable covers/pad for application on pipes: pipe fittings, valves, flanges etc vessels & equipments, tubes etc in hot services.				
01	Dimension (mm)	As per drawing/sketch provided by OEM.			
02	Thickness (mm)	25-100			
1. Specification of Protective jacketed material					
i	Vest Cover	Liner Fibre Glass Fabric			
ii	External Top Cover Fabric (for cold face)	Polymer Coated Fibre Glass fabric Temp. resistance 300 Deg. C, oil & water resistant			
iii	External Bottom Cover fabric (for hot face)	High silica cloth for Temp Resistance up to 900 Deg C			
2.	Specification of insulation Material	Ceramic Fibre Blanket (As per IS 15402)			
i	Classification Temperature	1260 degree Celsius			
ii	Thickness	25 – 100mm			
iii	Bulk Density	128kg/m3			
iv	Shot content on 70 mesh (%)	<30			
v	Tensile strength (KPa)	>40			
vi	Mean Fibre Dia (Micron)	2-4			
vii	Linear Shrinkage (%) At 1200 Deg. C for 24 Hrs	3.5			
viii	Thermal Conductivity (W/mK) Max.	1000C	2000C	3000C	5000C
		0.046	0.072	0.078	0.150
ix	Chemical composition	SiO2%		49-58	
		Al2O3%		41-48	
		ZrO2%		0-7	
		FeO3%		<0.1	

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3	Hardware & Non Metal fastening	
i)	Buckle/Draw Stings	Stainless steel (min SS 316), High Temp Braided Chord of fibre glass
ii)	Stic Pins	Stainless Steel (min SS 316), Pins to prevent the insulation from movement inside the cover
iii)	Stitching	Double sewn with Teflon coated Fibre glass wrapped stainless thread. The sewing thread shall not resolve or decompose in typical chemical plant environment.
iv)	Belting	High Temp Fabric same as used in hot face cover
4	Other Properties	
i	Fire Resistance (As per BS 476 Part-4)	Non-Combustible
ii	Chemical Stability/Resistance of Corrosion/water	Good
iv	Shock Resistance	Excellent

Rockwool Insulation shall be of water Repellent Grade and tested as per BS: 2972 for Water Absorption. Maximum water absorption is 0.5 kg/m² in 48 hours duration.

Precautions must be implemented in the design and fabrication of the insulation jackets to avoid the insulation material from sagging causing reduction of the insulation properties of the jackets.

Cold Insulation:

Insulation material and specifications for cold insulation for operating temperatures up to (-) 180°C and dual temperature (cold/hot) service where, upper temperature limit is 125°C shall be as given below for all sizes of piping/equipment:

- Polyurethane Foam

Preformed pipe section's and radial lags (for higher diameter pipe) of polyurethane foam of self-extinguishing type shall be in accordance with ASTM C591 TYPE-II Grade 2. The physical requirement of bulk density, chloride content, thermal conductivity and PH value of the material shall be as follows:

Temp. Limit Bulk density:	Upto (-)180°C & 120°C (max) 35.0 to 39.9kg/m ³
Chloride content :	20 ppm (max)
Thermal conductivity :	0.221 mw/cm°C at mean temp. 10 deg C
PH Value :	Neutral.
Closed cell content :	95% (min)

High density polyurethane foam block of bulk density more than 300 Kg/m³ shall be used for supports.

- Polyurethane Foam Cast-in-Situ

Cast-in-Situ Polyurethane Foam of density 42±2 kg/m³ conforming to IS: 13205 shall be used. High density polyurethane foam block of bulk density more than 300 Kg/m³ shall be used for supports.

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Temp. Limit : Up to (-) 45°C and 120°C (max.)

- Polyisocynaurate

Temp. Limit : Up to (-) 180°C and 125°C (max.)

Other insulating materials may be used provided they have the same or better properties and durability aspects.

Insulation material specification/ thickness/application mentioned in this document are the minimum requirements. Insulation specification/ thickness/ application shall be based on design calculation of thermal conductivity, insulation class, relevant IS/ ASTM codes etc. Same shall be submitted to the Owner with necessary design calculations, drawings, test certificates and durability parameters. LSTK shall submit detailed material specifications, durability parameters assured, test certificates and application procedure to OWNER/ PMC approval.

3.2 AUXILIARY MATERIALS FOR CLADDING

a) Aluminium Cladding

- Horizontal Vessels

Aluminium sheet as per IS-737 (designation 31000, condition H3 for flat sheet & 31500/51300, H4 for corrugated sheets)) shall be used for cladding. Insulation on overall piping, vessel and equipment, cladding will be coated on the side in contact with insulation with 3 mil thick polysurlyn film.

Specifications for aluminium Cladding material shall be as follows:

Material	Reference Code / Standard	Thickness	Application
Aluminium sheet with applied moisture barrier of 3 mil thick Polysurlyn coating	IS : 737 / ASTM C-653	22 SWG (0.71mm)	For all piping, tanks, vessels, heat exchanger, flanges, valves, equipments etc. upto 24" outside dia
		20 SWG (0.91mm)	For piping, tanks, vessels, heat exchanger, flanges, valves etc. above 24" outside dia
Removable cover for flanges, valves etc. shall be made out of minimum 18 SWG thickness Aluminium Sheets.			

- Vertical Vessels

Cladding material for vessels with insulation O.D. 900 mm and less shall be same as for pipes. For vessels above 900 mm insulation O.D. 22 SWG corrugated aluminium sheet as per IS-1254 or ribbed aluminium sheet 32 mm x 5 mm deep corrugations may be used.

Aluminium Foil to protect stainless surfaces in Temperature below 0 deg c shall be 0.1 mm (42 SWG) thick per ASTM 8209 alloy 3003 H16 or IS-737 designation

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31000 (OldNS3) condition H3. For securing aluminium foil on stainless steel surface 24 SWG thick x 20mm wide aluminium bands shall be used.

- b) **Screws**
Screws used with aluminium sheeting shall be of self tapping type, A No.8x12mm long cadmium plated / SS of high quality at intervals of 150mm.
- c) **S-Clips.**
Aluminium, 20x1.5mm or 25mm wide stainless steel banding bent to form a shape of "S" provide a minimum lap of 50mm.
- d) **Bands for securing cladding.**
Aluminium of dimensions 12mm width x 0.56 mm thick (24 SWG) for pipes. Stainless Steel bands Type 304, 0.4mm thick x 13mm wide for large dia pipes (above 24") and cylindrical equipment up to outside dia 900mm, 0.5mm thick x 19mm wide for cylindrical equipment above 900mm outside dia meter.
- e) **Quick release clips for removable covers.**
Suitable quick release clips will be made as shown in fig. 7 from 20Cm width x 20 SWG aluminium sheet and some fig.7 from 20mm width x 20 SWG aluminium sheet and some suitable rectangular ring.
- f) Sealant for cladding joints with Foster 95-44 /TIKI F9544.
- g) The vapour barrier mastic shall be Foster 60-38/39 /TIKI M6038/39
- h) Adhesive for cold insulation shall be Foster 81-33 /TIKI P8133
- i) Vapour Stops at pipe support location shall be Foster 90-66 /TIKI F9066
- j) **Rivets:** Aluminium 'POP' blind eye type / Stainless Steel 9.5mm long x 5mm dia meter.
- k) Filler material shall be PUF dust or mineral wool mixed with specified adhesive shall be placed lightly so as to fill irregular voids and sealant shall be Foster Foam Seal Sealer 30-45. Glass cloth to be used for vapour barrier reinforcement shall be open weave 10 mesh having glass fibre thickness of 5 mils.

Galvanised steel sheets/ Annealed galvanised steel sheets/ Galvanised colour coated sheet are strictly **PROHIBITED** for use in cladding works. Other cladding materials (except G.I.) may be used provided they have the same or better properties and durability aspects, after prior approval from Owner/PMC.

Cladding material / auxiliary material specification/ thickness/ application mentioned in this document are the minimum requirements. Cladding material/ auxiliary material specification/ thickness/ application shall be based on design calculation of thermal conductivity, insulation class, corrosion aspects, durability, relevant IS/ ASTM codes, etc. Same shall be submitted to the Owner with necessary design calculations, drawings, test certificates and durability parameters.

LSTK shall submit material specifications, durability parameters assured, test certificates and application procedure to OWNER/PMC approval.

4.0 **INSPECTION.**

4.1 **General**

	<u>PLANT: SYNGAS PURIFICATION UNIT FOR COAL TO AMMONIUM NITRATE PLANT</u> <u>OWNER: Bharat Coal Gasification and Chemicals Limited</u> CONSTRUCTION/ERECTION, PRE-COMMISSIONING, COMMISSIONING AND START-UP	PNCN/ PC288/E/001/PART-II-SEC - 7.0	P	
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All insulation material shall be subject to inspection by owner before application. In case of doubt, Owner's representative will have the liberty to get the material tested by the contractor at any approved test laboratory. Any material not meeting specified requirement will be rejected and the rejected material shall have to be replaced by the contractor with material of specified type and quality. Insulation found to be improperly installed shall be removed and reinstalled properly by the contractor.

Contractor shall maintain detailed log of various insulation works and same shall be updated on daily basis. QA/QC checks of work done and materials shall be also registered in the daily logs. Owner will have the liberty to check the logs.

4.2 Inspection

Inspection of materials and / or installation by owner shall not relieve the contractor of his responsibility to ensure that finished insulation conform to specified requirements and is free from defects, contractor shall correct any defects due to poor workmanship. Contractor shall maintain test certificates and other relevant data from manufacturer.

4.3 Test for thickness

Test for thickness shall be carried out after application. Thickness at any point shall not be less than 2mm than the indicated designed thickness and excess thickness up to 115% of the designed thickness is permissible. .

4.4 Testing for bulk density

Testing of bulk density of the insulating materials shall be carried out before the application of insulation. This should be within $\pm 15\%$ of the specified value. Test location shall be selected by owner and its repair shall be done by contractor.

5.0 APPLICATION

5.1 General

Insulation thickness shall be as per design calculations as specified in the drawings/ insulation schedule/ specification/isometric drawings prepared for equipments/piping.

Contractor shall submit detailed calculations and procedure for different insulation works based on relevant IS / ASTM codes.

5.2 No. of Layers

When insulation thickness exceeds 75 mm, the insulation shall be applied in multi-layers with all joints staggered. Each layer will be separately secured with metallic bands/wires.

No. of layers shall be as follows:

Insulation Thickness

Up to 75mm
76 to 150 mm
151 and above

No. of Layers (Min.)

1 Layer
2 Layers
3 Layers or more.

	<u>PLANT: SYNGAS PURIFICATION UNIT FOR COAL TO AMMONIUM NITRATE PLANT</u> <u>OWNER: Bharat Coal Gasification and Chemicals Limited</u> CONSTRUCTION/ERECTION, PRE-COMMISSIONING, COMMISSIONING AND START-UP	PNCN/ PC288/E/001/PART-II-SEC - 7.0	P	
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5.3 GENERAL REQUIREMENTS

5.3.1 Surface preparation

- Surface to be insulated shall be cleaned of all dirt. Oil loose scale etc. by wire brushing. Insulation works shall commence only after necessary clearance from QA/QC for painting works as per painting specification. All insulation shall be applied at ambient temperature and both the metal surface and insulation material shall be dry prior to application of insulation.
- The surface for cold insulation shall be then coated with a bitumen emulsion or a mastic coating.
- If the vessel is made of stainless steel, it shall be wire-brushed. with stainless steel wire brush.

5.3.2 Expansion / contraction joint

Depending on the type of insulation used the operating temperatures and nature of the material it may be necessary to provide expansion/contraction joints on vessels or pipes to prevent the insulation from rupturing/buckling when the surface expands/contracts. Joints are to be designed as per relevant IS / ASTM codes.

5.3.3 Filling of Voids

All voids, irregularities and joints shall be packed with loose insulation material/insulation cement trowelled smooth whichever is applicable.

6.0 MEASUREMENT OF INSULATION WORK.

6.1 Measurement of insulation works shall be as per IS: 14164.

7.0 GUARANTEE

- There shall be a surface temperature recording as mentioned in the Design Parameter to be performed with the help of Thermography Camera, post the line/ equipment is charged in operating conditions. The same shall be in LSTK's scope and LSTK shall give a detailed report of the same.

-The guarantee test shall be carried out when plant is fully operative.

-The surface temperature, reading shall be taken at six points per pipe line and at each point it shall be taken on all four sides in top, bottom, left side and right side.

-The above reading shall be taken at 2 hours intervals and shall be taken for 18 hours starting from 11 a.m. in the morning.

- Simultaneously ambient temperature shall be taken as per IS: 14164

- A graph shall be plotted between ambient and surface temperature reading

- From this graph the surface temperature against ambient temperature shall be found out

	PLANT: SYNGAS PURIFICATION UNIT FOR COAL TO AMMONIUM NITRATE PLANT OWNER: Bharat Coal Gasification and Chemicals Limited CONSTRUCTION/ERECTION, PRE-COMMISSIONING, COMMISSIONING AND START-UP	PNCN/ PC288/E/001/PART-II-SEC - 7.0	P	
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- The ambient and surface temperature shall be measured by the instrument provided by the contractor. The instrument shall be calibrated to the satisfaction of owner/consultant.
- The contractor is required to guarantee the surface temperature of 60°C (max.) for equipments and piping in case of Hot Insulation. For cold insulation of equipments and piping, the difference between skin temperature and ambient temperature shall not exceed 2 °C.
- Ambient temperature and surface temperature shall be measured by duly calibrated instruments provided by CONTRACTOR.
- The CONTRACTOR shall undertake immediate replacement of insulation material damaged in transit, storage or application, at no additional cost to Owner.
- LSTK shall produce required number of copies of test certificates as per relevant IS/ASTM Standard. LSTK shall certify/ensure that Test to be done are from NABL approved laboratory, approved by Owner.
- All materials are new and unused and are as per specifications called for in this standard.
- The operating thermal conductivity shall be as specified
- The workmanship shall be in accordance with good practice.
- **Other terms & conditions of the guarantee clause shall be as per NIT / purchase order / Commercial documents of ITB.**

Insulation Contractor List

M/s Lloyd Insulations (India) Limited, New Delhi
M/s Poiner Insulation ,Ghaziabad
M/s Insulrifef, Mumbai
M/s Polybond Insulation Pvt Ltd, Chhattisgarh (India)
M/s Minwool Rockfibers Ltd, Hyderabad
M/s Murugappa Morgan Thermal Ceramics Ltd, Chennai
M/s Associate Insulation Co.
M/s HIL, Hyderabad

**COAL TO 2000 TPD AMMONIUM NITRATE PROJECT OF M/S
BCGCL AT LAKHANPUR (ODISHA) INDIA**

**TECHNICAL SPECIFICATION
FOR
FUEL OIL AND TANK PACKAGE**

ANNEXURE-I

(SYSTEM WRITE UP FOR FUEL OIL HANDLING SYSTEM)



**BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA**

	TECHNICAL SPECIFICATION FOR FUEL OIL AND TANK PACKAGE COAL TO 2000 TPD AMMONIUM NITRATE PROJECT OF M/S BCGCL AT LAKHANPUR (ODISHA) INDIA	SPECIFICATION. No: PE-TS-497-166-002-A001	
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SYSTEM WRITE UP FOR FUEL OIL HANDLING SYSTEM

1.0 SYSTEM DESCRIPTION

Light Diesel Oil (LDO) shall be used as initial ignition, initial start-up of the boiler and up to a load of 30% MCR. This shall also be used for coal flame stabilization of the steam generator. The Fuel Oil Handling System to be considered comprises unloading & storage of LDO and methanol in near future. The basic operation & control philosophy of fuel oil unloading & storage system is described in succeeding sections. The bidder shall provide all the features as specified herein including other features as required for safe, efficient and trouble free operation of the system.

Fuel Oil Characteristics (LDO & Methanol) are provided under **Project information**.

1.1 LIGHT DIESEL OIL SYSTEM

- 1.1.1 LDO shall be delivered to power station by two (2) nos road tankers. The road tankers shall be unloaded through flexible metallic / neoprene unloading hoses of **min. 8.0m length** with fire safe type ball valve for isolation and a hose stand for each unloading hose. The LDO unloading header will have 5 Nos. unloading points and one no spare connection.
- 1.1.2 LDO from unloading header shall be pumped to LDO storage tank with the help of Three (3) Nos (2W+1S) unloading pumps as indicated in the P&ID for LDO Unloading and Storage system. The LDO unloading pumps are of rotary positive displacement, twin screw type or Centrifugal type and provided with matching capacity duplex strainers at their suction with interconnecting piping and valves as shown in the P&I diagram for LDO System, Drwg No. - **PE-DG-544-166-A001**.
- 1.1.3 Two (2) nos. LDO storage tanks of net capacity 200 m³ each are envisaged.
- 1.1.4 Interconnecting piping, valves and instruments as indicated in the Process & Instrumentation diagram for LDO system under specification.

1.2 DRAIN OIL SYSTEM, SUMP SYSTEM & OIL WATER SEPARATION

- 1.2.1 The drains from Fuel oil unloading pumps and their strainers shall be collected by gravity in a drain oil tank to be located in the Fuel oil unloading cum forwarding pump house. This oil from drain oil tank shall be pumped to LDO storage tanks by drain oil pumps (1 W + 1 S). Drain oil tank & drain oil pumps are in BHEL Trichy scope.
- 1.2.2 All oil drain headers will have a size not less than 25 NB and adequately sloped.
- 1.2.3 A single chamber oil water separator (OWS) is envisaged for separating the oil water mixture generated in fuel oil area. The oil separated through gravity in OWS shall be collected in oil pit, through an 80 NB perforated skimmer MS pipe and then this oil will be pumped to LDO storage tank with the help of two (2) nos., 1 W + 1 S, vertical screw recovery oil pumps of capacity 5 m³/hr each. The separated water with traces of oil shall be pumped to effluent treatment (ETP) plant through sump pumps (1W + 1S) of sufficient capacity by Effluent Transfer system supplier (BHEL PEM-WSE).

During rainy season, water from unloading area and tank dyke area having very little or no trace of oil shall be routed from sump outside Tank dyke area to nearest plant drain, not to the OWS facility.

The above scheme for oil water separation is shown in P&I diagram for LDO System given under specification.

- 1.2.4 Two (2) nos. Sump Pumps (1W+1S) (In BHEL Trichy scope) shall be provided inside Fuel oil pump house (FOPH) to pump the surface drain from FOPH to Oil water separator. For detailed scheme refer P&ID for LDO system.

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2.0 INSTRUMENTATION & CONTROL

2.1 Operation and Control of Fuel Oil unloading and storage system will be from DCS (BHEL scope) based control panel provided in Fuel oil pump house.

2.2 Instrumentation shall be as shown in Process & Instrumentation Diagram for LDO unloading & Storage system given under this specification.

2.3 Following functions shall be done through DCS:

2.3.1 Filling any of the LDO/LDO storage tanks by ensuring proper and safe selection of these tanks. Simultaneous filling and emptying of same LDO storage tanks will be avoided. Signals from motorized valves at the inlet and outlet of storage tanks shall be used for this purpose.

2.3.2 Start the LDO unloading pumps **through DCS** for filling the tanks after ensuring safe start permissive. The safe start permissive shall comprise of:

- MCC healthy
- Selected storage tank level not HI (high).
- Pump suction header inlet pressure not LO (low).
- DP across pump suction strainer not HI (high).
- Valve at tank inlet is open

2.4 Stop the running unloading pump(s) **through DCS** in case of annunciation for Level HI in corresponding tanks.

2.5 Stop/Trip the running LDO unloading pump(s) automatically in case of following:

- Level HI-HI in corresponding tanks.
- Pressure Hi in pump discharge header
- DP across corresponding suction strainer is HI.

2.6 Start standby unloading pump **through DCS** only in case running pumps trips either due to any mechanical or electrical failure

2.7 Start standby drain oil pump **through DCS** only in case running pumps trips either due to any mechanical or electrical failure

2.8 Start the sump pump in respective areas **through DCS** on receipt of level alarm HI or if physically the level is found to be high after ensuring safe start permissive. The safe start permissive shall comprise of:

- MCC healthy

2.9 Stop the running sump pump automatically in case of annunciation for Level LO in sump

2.10 Start standby sump pump **through DCS** only in case running pump trips either due to any mechanical or electrical failure.

2.11 Signals (annunciation & indication) from various switches / transmitters.

2.12 Running status (on/off) of all pumps.

2.19 All signals from the field instruments will be first terminated on a field mounted Junction box (JB) before transmitting the signals to DCS.

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COAL TO 2000 TPD AMMONIUM NITRATE PROJECT OF M/S BCGCL AT LAKHANPUR (ODISHA) INDIA

TECHNICAL SPECIFICATION FOR FUEL OIL AND TANK PACKAGE

ANNEXURE-II

(EQUIPMENT DESIGN CRITERIA)



**BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA**



**TECHNICAL SPECIFICATION FOR
FUEL OIL AND TANK PACKAGE**

**COAL TO 2000 TPD AMMONIUM NITRATE
PROJECT OF M/S BCGCL AT LAKHANPUR
(ODISHA) INDIA**

SPECIFICATION No: PE-TS-544-166-002-A001

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A. FUEL OIL HANDLING SYSTEM

1. EQUIPMENT SELECTION & DESIGN CRITERIA/ DATA SHEET

1.1 FO STORAGE

S.No.		LDO STORAGE TANKS
1	Storage Medium	LDO
2	No. of Tanks	2 (two no)
3	Type of Construction	Vertical Cylindrical, non-pressure type with atmospheric vents fitted with flame arrestor fixed cone roof type.
4	Effective Tank Capacity (m ³)	200
5	Dimensions	7.0 m dia x 7.0 m Ht
6	Design & Construction Code	IS 803 / API650
7	Design Pressure	Atmospheric
8	Corrosion allowance	1.5 mm
9	Material of construction	IS 2062 Gr A/B with minimum plate thickness as 6.0 mm.
10	Venting Capacity	As per API 2000 / equivalent
11	Joint efficiency	85 % on all butt-welded joints

NOTES:

- a. Design and GA drwg of LDO tanks will be done by BHEL. Bidder to provide the design calculation of roof structure (Stadd analysis), basic design (for information) and fabrication drawings of tanks in line with GA drwg prepared by BHEL.

1.2 UNLOADING PUMPS & RECOVERY OIL PUMPS

- a. Refer below table for technical requirements of Pumps.

	Characteristics	LDO Unloading Pumps	Recovery oil pumps
1	Type of Pumps	Twin Screw Positive Displacement	Vertical Single Screw positive displacement.
2	No. &Capacity of Pumps	As per scope of supply	
3	Type of Duty	Intermittent	Intermittent
4	Type of Drive	Direct driven by Electric Motor	
5	Location	Indoor	Indoor
6	Nature of Fluid to be pumped	LDO	LDO
7	Design Viscosity range	2-20 cST	5-50 cST



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8	Sealing	Manufacturer Specific	
9	Design Code	Manufacturer specific.	
10	Bearings	Antifriction type	Manufacturer specific
11	Material of Construction		
i)	Casing	Cast Iron to IS 210 Gr FG 260	Cast Iron to IS 210 Gr FG 260/ IS:1239 (Heavy grade)
ii)	Casing lining, if applicable	Manufacturer specific	
iii)	Rotor/ Impeller	SS to AISI-431	2-2.5% Ni Cast Iron
iv)	Rotor housing, if applicable	CI AS PER IS 210 GR. 260	Manufacturer specific
v)	Shaft	SS to AISI-431	SS to AISI-304
vi)	Base Plate	Fabricated from MS to IS 2062	
vii)	Coupling	Manufacturer specific	

- b. Piping in discharge side of pump shall in no case be lower than pump discharge nozzle size.
- c. Head / discharge pressure of various pumps shall be decided during detailed engineering stage based on layout requirement & pressure drop. In addition to the head calculated, margin of 1 kg/cm² to be considered while selecting the unloading pump head.
- d. For selecting motor rating, criteria shall be as follows:
- 15% margin over BHP at unloading pump design head.

1.3 STRAINERS FOR LDO UNLOADING PUMPS

S.No.	Characteristics	Value
01	Flow Rate	To match pump flow rate
02	Operating Pressure, maximum kg/cm ² (g)	Unloading pressure of oil
03	Operating temperature, ° C	Unloading temperature of oil.
04	Design Pressure , kg/cm ² (g)	1.1 times the operating pressure, min.
05	Design Temperature, ° C	65
06	Fluid Viscosity	As per Fuel Oil Characteristics
07	Straining area	6:1
08 a)	Pressure drop in clean condition	0.15 kg/cm ²
09 b)	Maximum permissible pressure drop under 50 % clogged condition	0.3 kg/cm ²
10	Screen basket data	
a)	Dia of perforations	40 mesh
b)	Minimum thickness	Bidder specific
11	End Connection details	
a)	Inlet & outlet size	Shall match connected upstream and downstream pipe size
b)	Type	Flanged
c)	Details / Standard	IS: 6392 /ANSI B 16.5 /Equivalent.
12	Material of Construction	
a)	Body	MS to IS: 2062 (min. 8mm thk) or Pipe to IS:3589 (min. 6.35 mm thk)



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b)	Cover	Fabricated from IS 2062 PLATES
c)	Screen basket	SS 304

1.4 DATA SHEET FOR OIL HOSES

S.No	Characteristics	Value
1	Type	Flexible rubber hose confirming to BS 1435 (latest edition), type S-7
2	Size	80 NB X 8.0 m long for LDO
3	Quantity	As indicated in scope of supply
4	Type of end connection	To match road tanker unloading nozzle
5	design temperature of Hose	105 deg.C.
6	end connections	galvanized in accordance with BS: 729/zinc sprayed as per BS: 2569, Part-1.

1.5 VALVES

S.No.	Characteristics	Specification
	Design Features	
1	General Requirement for all valves	i) All valves shall be provided with hand wheels, extension spindles and floor stand or any other arrangement wherever required so that they can be operated manually with ease by a single operator from the nearest operating floors either at a lower or higher elevation as the case may be. Wherever necessary for safety purpose, locking devices shall be furnished with valves. Gear Operated valve shall be provided for valves where force applied is more than 25Kgf. In the case of those valves with extended spindles, indicators will be fitted both to the extended spindles and to the valve spindles.
2	Gate Valves	i) Gate Valves shall be used for isolation purpose. The gate valves shall be provided with hand wheel, position indicator and draining arrangement. ii) Gate Valves for sizes up to 40 NB shall be of class 800, forged carbon steel valves with solid wedge, OS and Y rising stem and bolted bonnet with deep stuffing box and lantern ring. Trim shall be of 13% chrome steel. Body material shall be to ASTM A105 and ends shall be socket welded. iii) For sizes above 40 NB valves shall be of class 150/300 (depending on service), Cast Carbon Steel gate valves. Face to face dimensions shall be as per ANSI B 16.10. Body material shall be ASTM A216 Gr. WCB and ends shall be flanged to ANSI 150/300 lbs rating with raised face. Other particulars shall remain same as above. iv) The valves shall conform to API-600/ API-602 and shall be tested to API 598/IS: 6157 requirements.
3	Globe Valves	i) Globe valves shall be used for regulation purpose for all sizes in oil lines, they shall be provided with hand wheel, position indicator and draining arrangement.



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		ii) Globe valves for sizes up to 40 NB shall be of class 800 forged carbon steel valves with plug type disc. Other particulars shall be same as 2 (ii) above. iii) For sizes above 40 NB, valves shall be class 150/300 (depending on service) Cast Carbon steel globe valves with plug or ball type disc, other particulars shall be same as 2 (iii) above. iv) The valve shall conform to BS, 1873/BS: 5352 and shall be tested to BS: 6755/ BS: 5146 requirements.
4	Check Valves.	i) Check Valves shall be used for non-return services for all sizes in oil lines. ii) For sizes up to 50 NB, check valves shall be of class 800 forged Carbon Steel horizontal lift type, with bolted cover, Valves shall have 13% Chrome Steel trim and body material to ASTM A 105, Ends-shall be socket welded. iii) For sizes above 50 NB, check valves shall be of class 150/300 (depending on service) Cast Carbon Steel valves of swing check type having bolted cover. Trim shall be of 13% Chromium Steel and body material to ASTM A 216 Gr. WCB. Ends shall be flanged to ANSI Class 150/300 lb rating with raised face. iv) The valves shall conform to BS: 1868 / BS: 5352 / ANSI B16.34 and shall be tested to BS 6755/ BS: 5146 / IS: 5312 / API598 requirements.
5	Oil Line Ball / Plug Valves	i) Ball valves shall be used for isolation purpose in oil lines. These shall have 'port' position indicators with CLOSE/OPEN indications marked on valve body. ii) Ball valves shall be of class 150 full-bore type with face to face dimension as per ANSI B 16.10. Body material for plug/Ball Valves shall be ASTM A216 Gr. WCB. The ball shall be of SS AISI 316 quality and plug material (for plug valves) shall be hardened steel to ASTM-A-216 Grade WCB with suitable heat treatment. Plug valves shall be self-lubricated taper type of proven design. iii) Ball valves shall be of safe pattern for internal (line) & external leakage. Ball valves in general shall confirm to BS: 5351/ and to BS6755 Part-2/API 607/ Equivalent for fire safe test. iv) Plug valves shall be of fire safe pattern for external leakage only. Plug valves in general shall confirm to API 6D/ Equivalent for design & manufacturing standard and to BS6755 Part-2/ API607/ Equivalent for fire safe test.



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1.6 PIPES, FITTINGS & FLANGES

Sr. No	Size	Material Standard/ Other details	Dimension Standard
A	PIPE		
a.	FUEL OIL		
1	Fuel Oil Pipes	API 5L GR.B (ERW) / A106 Gr B.	ASME B36.10/API 5L /Equivalent
2	Type of end connection (Pipe to pipe & Pipe to equipment)	Butt welded for pipe size 65 NB & above; however, near equipment, this shall be of flanged type. Socket welded for 50 NB & below; near equipment this may be either socket welded or flanged.	Socket welding – ANSI B 16.11 Butt welding – ANSI B 16.25 Flanged- ANSI B 16.5 /BS 4504 / IS 6392; Class- As per relevant standard & suitable for intended service
B.	FITTINGS & FLANGES		
a.	FUEL OIL		
1.	Fittings (Elbow, Tees and Reducers)	Material Standard	Dimension Standard
	50 NB and below	Forged carbon steel to ASTM A 105	SW ends to ANSI B 16.11 (3000#)
	65 NB and above	Fabricated from parent pipe / Carbon Steel to ASTM A 234,Gr.WPB	BW ends to ANSI B 16.9, Sch.40
2.	Slip on Flanges / Blind Flanges	Material Standard	Dimension Standard
	All sizes	ASTM A 105/ Fabricated from IS2062 plate	As per ANSI B16.5, Class 150/BS 4504/ IS 6392; class 150 lb/ equivalent to relevant standard.
3	Gaskets		
	Gaskets for Fuel Oil and waste oil service	Spiral Wound SS316	
4	Bolts/Studs	ASTM A193 Gr. B7	
5	Nuts	ASTM A193 Gr. 2H	



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1.7 VELOCITIES FOR SELECTING PIPING

Sizes of pipelines shall be selected so that velocity in pipes may not exceed the following maximum velocities		
Sr. No	Description	Maximum Velocity
A	Oil	
1	Pump Suction	0.6-1.2 m/s
2	Pump Discharge	1.0-1.5 m/s

1.8 FUEL OIL CHARACTERISTICS

SI no.	Characteristics	Light Diesel Oil (LDO)
1.1	Kinematic Viscosity in centistokes at 40° C	2.5 to 15
1.2	Sediment percent by mass (Max.)	0.10
1.3	Total Sulphur percent by mass, Max.	1.5
1.4	Ash percentage by mass (Max.)	0.02
1.5	Water Content Max, % Volume	0.25
1.6	Density at 15°C(approximate), Kg/m ³	810-845(assumed, to be reported by customer)
1.7	a) Flash point, Min- Pensky Martens b) Pour point:	66°C 21°C in Summer and 12°C in Winter
1.8	Gross Calorific Value (Kcal/kg)	Of the order of 10,000

BHEL PEM	DATA SHEET FOR CONDENSATE STORAGE TANK		DOC NO: PE-DC-544-100-N127
			SHEET NO: 01 OF 01
	PROJECT TITLE: 2000 TPD coal to Ammonium Nitrate plant		REV NO: 00
1	SERVICE IDENTIFICATION	CONDENSATE STORAGE TANK	
2	P&ID NO.	PE-DG-544-H104	
3	SYSTEM	P&ID FOR DM SYSTEM FOR GASIFIER AND STEAM GENERATION PLANT (SGP)	
4	CAPACITY (EFFECTIVE) (m ³)	2000	
5	NUMBER REQUIRED	1	
6	STORAGE MEDIUM	DM WATER	
7	TYPE	VERTICAL, CYLINDRICAL	
8	TENTATIVE SIZE	TO BE DECIDED BY TANK SUPPLIER	
9	PRESSURE CLASS	DESIGN FOR FILLED WATER HEAD / ATMOSPHERIC	
10	MATERIAL OF CONSTRUCTION	MILD STEEL TO IS:2062	
11	DESIGN TEMPERATURE	60 deg C	
12	LOCATION OF INSTALLATION	OUTDOOR	
13	NOZZLE CONNECTIONS REQD /	AS PER ENCLOSED SKETCH / SOCKET WELDED FOR SIZE < NB50 & BW FOR SIZE > NB50	
	END CONNECTION	SOCKET WELDED FOR SIZE < NB50 / BUTT WELDED FOR SIZE > NB50	
14	PIPE / NOZZLE MATERIAL	STAINLESS STEEL TO 'SA 312 TP 304'	
15	VALVES MATERIAL	STAINLESS STEEL	
16	VALVES END CONNECTION	SOCKET WELDED FOR SIZE < NB50 / BUTT WELDED FOR SIZE > NB50	
17	INSTRUMENTS / ACCESSORIES REQUIRED	(a) CONSERVATION VENT VALVE /NAOH BREATHER	
		(b) OVERFLOW OF 150 NB & DRAIN PIPING OF 80 NB WITH DRAIN VALVE	
		(c) SEAL POT WITH DRAIN VALVE ETC FOR OVERFLOW	
		(d) LEVEL GAUGE TO COVER ENTIRE RANGE	
		(e) 2 NOS TAPPINGS WITH NB 25 ROOT VALVES	
		FOR LEVEL TRANSMITTERS (2 Nos.)	
		(f) TWO SPARE CONNECTION OF 200 NB AND 150 NB WITH SPARE VALVES	
18	SURFACE PREPARATION	AS PER CUSTOMER'S APPROVED PAINTING SCHEDULE FOR TANK,BREATHER AND SEAL POT	
19	INSIDE PROTECTION		
20	EXTERNAL PAINTING		
21	MANHOLE	TWO (2) NOS. ONE ON SHELL & OTHER ON ROOF	
NOTE: 1. STANDARD ACCESSORIES IN LINE WITH PROJECT SPECIFICATIONS SHALL BE CONSIDERED. 2. ALL OTHER GENERAL TECHNICAL REQUIREMENTS / ACCESSORIES & SPARES AS PER CUSTOMER TENDER			

4015	GASIFIER SURGE TANK REQUIREMENT			
	PDIL Comment-16.04.26	BHEL Response 04.05.26		
1	LSTK contractor to note that,some basic documents needed primarily to understand any system.. Like what is purpose of the system/equipment, where it will work and how this equipment will work. In absence of basic engineerin documents like process flow diagram, heat and material balance, process description and design basis, this document can not be scrutinized.	Surge vessel are used as intermediate receiving vessel for CO2/N2 which are received from other packages and being used for coal feeding, lock receiver system pressurisation & depressurisation in gasifier Island. Refer Basic scheme document 5801-TRY-4012. Sheet 5 of 5 the surge vessel purpose is clearly indicated. Mass flow with temperature and pressure inside the vessels is avialable in the document 5801-TRY-4009.		



GASIFIER - SURGE TANK REQUIREMENT

Equipment Name	Unit	Surge Tank 1 & 2 - For Coal Feed	Surge Tank 3 & 4 - For Coal and Ash Lock Pressurization
Equipment	Nos	2	2
Medium To be handled		CO ₂ / N ₂	CO ₂ / N ₂
Design Flow for each tank	Kg/hr.	30000	15000
Flow Requirement		Continuous	Intermittent
Design Pressure	Kg/cm ² (abs)	37.4	37.4
Design Temperature	°C	130	130
Max Operating Pressure	Kg/cm ² (abs)	34	34
Max Operating Temperature	°C	100	100
Storage Volume Required for each tank	m ³	55	110
Design Code		ASME Section VIII Division 1	
Corrosion / Erosion Allowance	mm	3	
M.O.C		SA516 Gr70	
Safety relief valve	Kg/cm ² (abs) Kg/cm ² (abs)	1 No. Open - 37.4 Blowdown – 7 %	1 No. Open - 37.4 Blowdown – 7 %

Customer: Bharat Coal Gasification and Chemicals Ltd.

Plant: Coal Gasification & Raw Syngas Cleaning Plant (LSTK 1 Package)

Section: Coal Gasification Plant

Engineer : MSR

Reviewer : SDR

Approver : SPL

Title: GASIFIER - SURGE TANK REQUIREMENT

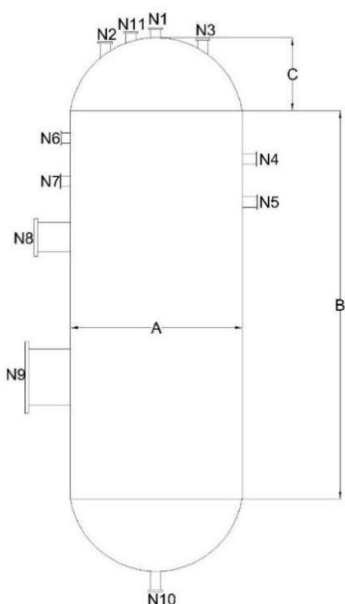
BHEL DRG. No.: BCR 4015

Sheet 2 OF 3

Rev 00



GASIFIER - SURGE TANK REQUIREMENT



Note:

1. Manhole and Drain provision to be provided
2. Provision for pressure and temperature transmitter to be provided
3. To be placed at ground level near gasifier structure
4. Surge tanks detailed Engineering & supply are in the scope of PEM, BHEL and dimensions A & B will be decided by PEM during detailed engineering.

Nozzle	Description	NB, mm	Quantity
N1	Outlet 1	50	2
N2	Outlet 2	80	2
N3	Inlet 1	80	2
N4	PT	50	2
N5	PG	50	1
N6	TE	40	1
N7	TG	M33	1
N8	Inlet 2	100	1
N9	Manhole	600	1
N10	Drain	50	1
N11	Safety Relief Valve	50	1

Customer: Bharat Coal Gasification and Chemicals Ltd.

Plant: Coal Gasification & Raw Syngas Cleaning Plant (LSTK 1 Package)

Section: Coal Gasification Plant

Engineer : MSR

Reviewer : SDR

Approver : SPL

Title: GASIFIER - SURGE TANK REQUIREMENT

BHEL DRG. No.: BCR 4015

Sheet 3 OF 3

Rev 00

**COAL TO 2000 TPD AMMONIUM NITRATE PROJECT OF M/S
BCGCL AT LAKHANPUR (ODISHA) INDIA**

**TECHNICAL SPECIFICATION
FOR
FUEL OIL AND TANK PACKAGE**

SECTION - IA

ANNEXURE – III

QUALITY ASSURANCE AND INSPECTION REQUIREMENT



**BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA**

ANNEXURE-III QUALITY ASSURANCE AND INSPECTION REQUIREMENT FUEL OIL HANDLING SYSTEM

 PEM MAUX		STANDARD QUALITY PLAN FOR STRUCTURAL STEEL							QUALITY PLAN NO.:PE-QP-XXX-166-A803 PACKAGE-FULE OIL SYSTEM PROJECT- REV.NO. 0 DATE: 31/03/2012 SHEET 1 OF 1						
		SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
		1	2	3	4	5	6	7	8	9	D	M	C	CU	11
		1.0	Structural	a) Chemical Composition	M	Chemical Analysis	Sample	IS:2062/ Spec./Drg.	IS:2062/ Spec./Drg.	Mfr's TC	✓	P	V*	V	
		b) Mechanical test	M	Mechanical Properties	-do-	-do-	-do-	Mfr's TC	✓	P	V*	V			
		c) Dimensional conformity	M	Measurement	100%	-	-	Mfr's TC	✓	P	W**	V			
* In case material is procured from dealer, and co-related TCs are not available, check test on identified sample will be carried out at recognised testing laboratory. ** In case material is despatched directly from SAIL/IISCO plant to project site, the witnessing required is waived and material will be accepted on challan & MTC of SAIL/IISCO															
LEGEND: RECORDS IDENTIFIED WITH "✓" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT. M - MANUFACTURER C - MAIN VENDOR CU - BHEL/CUSTOMER/NOMINATED INSPECTION AGENCY "P" PERFORM, "W" WITNESS AND V VERIFICATION															
MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)				REVIEWING AGENCY (SIGN WITH DATE & STAMP)				APPROVING AGENCY (SIGN WITH DATE & STAMP)							

 STANDARD QUALITY PLAN FOR STEEL PLATE		QUALITY PLAN NO.:PE-QP-XXX-166-A804										
		PACKAGE-FULE OIL SYSTEM										
		PROJECT-										
		REV.NO. 0					DATE: 31/03/2012					
		SHEET 1 OF 1										
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS CHECKED	CATEGORY	TYP/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY			REMARKS
									P	W	V	
1.0	Steel Plate	a) Chemical Composition	MA	Chemical Analysis	Sample	IS:2062/Spec./Drg.	IS:2062/Spec./Drg.	Mfr's TC	3		2*,1	
		b) Mechanical test	MA	Mechanical Properties	-do-	-do-	-do-	Mfr's TC	3		2*,1	
		c) Dimensional conformity	MA	Measurement	100%	-	-	Mfr's TC	3	2**	1	
* In case material is procured from dealer, and co-related TCs are not available, check test on identified sample will be carried out at testing laboratory. ** In case material is despatched directly from SAIL/TISCO plant/Stock yard to project site, the witnessing required is waived and material will be accepted on MTC of SAIL/TISCO LEGEND CR - Critical characteristics MA - Major characteristics MI - Minor characteristics P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor 4-CUSTOMER MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP) REVIEWING AGENCY (SIGN WITH DATE & STAMP) APPROVING AGENCY (SIGN WITH DATE & STAMP)												

STANDARD CHECK LIST FOR: :Safety Relief Valve
 PACKAGE-FULE OIL SYSTEM
 PROJECT-
 CHECK LIST NO.:PE-QP-XXX-166-A805
 REV.NO.0
 DATE:31/03/2012



SL. No.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOC./ ACCEPTANCE NORMS	AGENCY				REMARKS
				M	C	CU	D	
1	Review of Material TC for body & stem	One/Lot	Appd.Data Sheet/ Relevant Std.	P	V	V	✓	
2	Hydro test of body	100%	Appd.Data Sheet	P	W	V	✓	
3	Set pressure	100%	-do-	P	W	V	✓	
4	Check for IBR TC	100%	-do-	P	V	V	✓	

Legend:

Records identified with ' ✓ shall be essentially included by contractor in QA documentation

M= Manufacturer, C= Main vendor

CU=BHEL/Customer

P= Perform, W= Witness, V= Verification

For IBR Valves, no physical inspection carried out by contractor/customer. Material will be accepted based on review of IBR test certificates.

MAIN VENDOR/SUB-VENDOR
 (SIGN WITH DATE & STAMP)

REVIEWING AGENCY
 (SIGN WITH DATE & STAMP)

APPROVING AGENCY
 (SIGN WITH DATE & STAMP)

STANDARD CHECK LIST FOR : PLUG VALVE
PACKAGE-FULE OIL SYSTEM
PROJECT-
CHECK LIST NO.:PE-QP-XXX-166-A806
REV.NO.-0
DATE: 31/03/2012



SL. NO.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOCUMENT/ ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY				REMARKS
					D	M	C	CU	
A.	<u>RAW MATERIAL</u> Valve Body & Plug:								
1	Chemical Composition	1/Heat	Appd. Data Sheet/ Relevant Std.	Material TC	✓	P	V	V	
2	Tensile, Elongation	1/Heat							
B.	<u>FINAL INSPECTION</u>								
1	Visual Exam.	100%	Appd.Drg./Data Sheet	Inspn. Report	✓	P	W	W	
2	Dimensional Check	100%	Appd.Drg./Relevant Std.	-do-	✓	P	W	W	
3	Hydro Test of Body & Seat	-do-	Appd. Data Sheet/No leakage	-do-	✓	P	W	W	
4	Pneumatic Test for Seat	-do-	Appd. Data Sheet/No leakage	-do-	✓	P	W	W	
5	Performance/Operation test	-do-	Smooth operation/ Full travel	-do-	✓	P	W	W	
6	Painting	100%	Tech. spec/Mfr's std.	-do-	✓	P	V	V	

Note:

1. All material of construction shall be as per approved drawing/Data sheet
2. For Actuator operating valves - actuator test certificates shall be furnished to BHEL for review.

Legend

M= MANUFACTURER

C = MAIN VENDOR

CU= BHEL/Customer

P= PERFORM; W= WITNESS; V= VERIFICATION

✓ Marked document to be furnished along with QA Doc. Pkg.

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

			STANDARD QUALITY PLAN FOR SUMP PUMP				QUALITY PLAN NO.: PE-QP-XXX-166-A807 PACKAGE-FULE OIL SYSTEM PROJECT- REV.NO. 0 SHEET 1 OF 2 DATE: 31/03/2012						
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
1	2	3	4	5	6	7	8	9	M	C	CU	D	11
1.0	RAW MATERIAL												
1.1	CASING/ROTOR(IMPELLER) HOUSING	i) SURFACE DEFECTS ii) DIMENSIONAL CONFORMITY iii) MECHANICAL & CHEMICAL TEST iv) HARDNESS TEST	MAJOR	VISUAL MEASUREMENT PHYSICAL PROPERTIES/ CHEM. ANALYSIS MEASUREMENT	100% 100% 1/HEAT 100%	APPD.DATA SHEET/ DRG./ MFR's DRG./IS:210 Gr. FG 200/RELEVANT STD.	APPD.DATA SHEET/ DRG./ MFR's DRG./IS:210 Gr. FG 200/RELEVANT STD.	IR & TC	P	V	-		
1.2	IMPELLER	i) SURFACE DEFECTS ii) DIMENSIONAL CONFORMITY iii) MECHANICAL & CHEMICAL TEST iv) HARDNESS v) DYPENETRATION TEST (AFTER MACHINING)	MAJOR	VISUAL MEASUREMENT PHYSICAL PROPERTIES/ CHEM. ANALYSIS MEASUREMENT DYPENETRATION TEST	100% 100% 1/HEAT 100% 100%	APPD.DATA SHEET/DRG. MFR's DRG./ RELEVANT STD.	APPD.DATA SHEET/DRG. MFR's DRG./ RELEVANT STD.	IR & TC	P	V	-		
1.3	SHAFT	i) DIMENSIONAL CONFORMITY ii) MECHANICAL & CHEMICAL TEST iii) UT DIA > 50MM **	MAJOR	MEASUREMENT PHYSICAL PROPERTIES/ CHEM. ANALYSIS UT	100% 1/HEAT 100%	MFR's DRG./ APPD. DATA SHEET/ MFR's CATALOGUE ASTM A388	MFR's DRG./ MFR's CATALOGUE/ RELEVANT STD. ASTM A388	IR & TC	P	V	-		
1.4	SHAFT SLEEVE	i) CHEMICAL ANALYSIS ii) HARDNESS	MAJOR	CHEMICAL MEASUREMENT	1/HEAT 100%	MFR's STD./MFR's CATALOGUE	RELEVANT STANDARD/ IS	IR & TC	P	V	-		
1.5	WEARING RINGS	i) MECHANICAL & CHEMICAL TEST ii) HARDNESS	MAJOR	PHYSICAL PROPERTIES/ CHEM. PROPERTIES MEASUREMENT	1/HEAT 100%	MFR's STD./MFR's CATALOGUE	RELEVANT STANDARD/ IS	IR & TC	P	V	-		
LEGEND: RECORDS IDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT. M - MANUFACTURER C - MAIN VENDOR CU - BHEL/CUSTOMER INDICATE "P" PERFORM "W" WITNESS AND V. VERIFICATION IR - INSPECTION REPORT, MTC - MTRL/MFR'S TEST CERTIFICATES MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)													
REVIEWING AGENCY (SIGN WITH DATE & STAMP)													
APPROVING AGENCY (SIGN WITH DATE & STAMP)													

		STANDARD QUALITY PLAN FOR SUMP PUMP				QUALITY PLAN NO.: PE-QP-XXX-166-A807 PACKAGE-FULE OIL SYSTEM PROJECT- REV.NO. 0 SHEET 2 OF 2 DATE: 31/03/2012							
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
1	2	3	4	5	6	7	8	9	M	C	CU	D	11
2.0	INTERNAL TEST												
2.1	CASING	SOUNDNESS OF CASTING	MAJOR	HYDROSTATIC TEST	100%	HYDROSTATIC TEST AT 200% OF PUMP RATED HEAD OR 150% SHUT OFF HEAD WHICHEVER IS HIGHER FOR 30 MTS.	NO LEAKAGE	IR & TC	P	V	V	✓	
2.2	SHAFT	DP ON SHAFT	MAJOR	DPT	100%	ASME E165	NO LINEAR DEFECTS	IR & TC	P	V	V	✓	
2.3	IMPELLER	RESIDUAL UNBALANCE	MAJOR	DYNAMIC/STATIC BALANCING	100%	ISO 1940 GR.6.3	ISO 1940 GR.6.3	IR & TC	P	V	V	✓	
3.0	FINAL INSPECTION												
3.1	OVERALL DIMENSION	DIMENSIONAL	MAJOR	MEASUREMENT	100%	APPD. DRAWING/ MFR's DRAWING	APPD. DRAWING/ MFR's DRAWING	IR & TC	P	W	W	✓	
3.2	PERFORMANCE TEST WITH LAB MOTOR	i) Q V/s HEAD ii) Q V/s POWER iii) Q V/s EFFICIENCY iv) NOISE LEVEL & VIBRATION	CRITICAL	MEASUREMENT	100%	APPD.DRG./MFR's DRG./APPROVED. DATASHEET/HIS	APPD.DRG./MFR's DRG./APPROVED. DATASHEET/HIS	IR & TC	P	W	W	✓	
3.3	STRIP TEST	STRIP TEST	CRITICAL	VISUAL (WEAR & TEAR)		**	85 dBA MAX. AT 1Mtr, & 75 MICRON MAX. NO UNDUE WEAR	IR & TC	P	W	W	✓	
3.4	REVIEW OF DOCUMENTATIONS					APPD. QAP	APPD. QAP		V	V	V	✓	
3.5	PAINTING	VISUAL	MINOR	VISUAL	100%	SPECIFICATION/ PAINTING SCH-EDULE/Mfr's Std.	SPECIFICATION/ PAINTING SCH-EDULE/Mfr's Std.	IR	P	V	-		** STRIP DOWN TEST ON 100% BASIS SHALL BE DONE INCASE ABNORMAL PERFORMANCE OTHERWISE SAME SHALL BE RESTRICTED TO BEARING INSPECTION ONLY
NOTE: ALL MATERIAL OF CONSTRUCTION SHALL BE AS PER APPROVED DATA SHEET/DRAWING													
LEGEND: RECORDS IDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT. M - MANUFACTURER C - MAIN VENDOR CU - BHEL/CUSTOMER INDICATE "P" PERFORM "W" WITNESS AND V VERIFICATION IR - INSPECTION REPORT, MTC - MTRL/MFR'S TEST CERTIFICATES													
MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)				REVIEWING AGENCY (SIGN WITH DATE & STAMP)				APPROVING AGENCY (SIGN WITH DATE & STAMP)					

		STANDARD QUALITY PLAN FOR BALL VALVE					QUALITY PLAN NO.: PE-QP-XXX-166-A808 PACKAGE-FULE OIL SYSTEM PROJECT- REV.NO. 0 SHEET 1 OF 3 DATE: 31/03/2012							
SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY				REMARKS	
									D	M	C	CU		
1	2	3	4	5	6	7	8	9				10		
1.0	MATERIALS:													
1.1	BODY & END PIECE	CHEMICAL COMPOSITION	CRITICAL	CHEM. TEST	ONE/ HEAT	APPD.DRG./ DATA SHEET	APPD.DRG./ DATA SHEET/ RELEVANT STD.	MATRL. TC/ MFR'S TC	✓	P	V	V		
		MECHANICAL PROPERTIES	- DO -	MECH. TEST	ONE/HEAT/ HEAT TREAT- MENT BATCH	- DO -	- DO -	- DO -	✓	P	V	V		
		HEAT TREATMENT	- DO -	REVIEW OF HT CHART	100%	- DO -	- DO -	- DO -/HT CHART	✓	P	V	V		
		IDENTIFICATION & CORRELATION	MAJOR	VISUAL	100%	- DO -	- DO -	INTERNAL RECORD		P	V	-		
		SURFACE DEFECTS	- DO -	- DO -	100%	MSS-SP-55	FREE FROM DEFECTS	- DO -	✓	P	V	-		
		DIMENSIONAL	- DO -	MEASU- REMENT	100%	APPD. DRG./ RELEVANT STD.	APPD. DRG./ RELEVANT STD.	LOG BOOK		P	V	-		
LEGEND: RECORDS, IDENTIFIED WITH ✓ ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER . C: MAIN VENDOR, CU: BHEL/CUSTOMER INDICATE "P" PERFORM, "W" WITNESS AND "V" VERIFICATION														
MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)				REVIEWING AGENCY (SIGN WITH DATE & STAMP)				APPROVING AGENCY (SIGN WITH DATE & STAMP)						



STANDARD QUALITY PLAN FOR
BALL VALVE

QUALITY PLAN NO.: PE-QP-XXX-166-A808

PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO.
SHEET

0
2 OF 3

DATE: 31/03/2012

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9	10				11
1.2	BALL, SPINDLE, GLAND, LEVER FASTENERS	CHEMICAL COMPOSITION	CRITICAL	CHEM. TEST	ONE/ HEAT	APPD.DRG./ DATA SHEET	APPD.DRG./ DATA SHEET/ RELEVANT STD.	TEST CERT.	✓	P	V	V	
		MECHANICAL PROPERTIES	- DO -	MECH. TEST	ONE/HEAT/ HEAT TREATMENT BATCH	- DO -	- DO -	- DO -	✓	P	V	V	
		HEAT TREATMENT (as applicable)	- DO -	REVIEW OF HT CHART	100%	- DO -	- DO -	- DO - / HT CHART	✓	P	V	V	
		SURFACE DEFECTS	MAJOR	- DO -	100%	MSS-SP-55	FREE FROM DEFECTS	- DO -	✓	P	V	-	
		DIMENSIONS	- DO -	MEASUREMENT	100%	APPD. DRG./ RELEVANT STD.	- DO -	LOG BOOK		P	V	-	
1.3	BODY SEAL, STEM SEAL, GLAND PACKING	DIMENSIONS	- DO -	- DO -	100%	- DO -	- DO -	INTERNAL RECORD		P	V	-	
		TEMPERATURE RESISTANCE	- DO -	TEMP. CHECK	100%	PTFE /RELEVANT STD.	RELEVANT STD.	TEST CERTIFICATE	✓	P	V	V	
2.0	IN-PROCESS INSPECTION:												
2.1	MACHINING OF BODY END-PIECE GLAND BALL, SPINDLE	DIMENSIONS	-DO-	MEASUREMENT	100%	MFG. DRG.	MFG. DRG.	LOG BOOK		P	V	-	
		SURFACE FINISH	- DO -	VISUAL	100%	- DO -	MFG. DRG./MFG. STD.	- DO -		P	V	-	
2.2	BALL, SPINDLE	HARDNESS	-DO -	HARDNESS TEST	100%	APPD. DRG./ DATA SHEET/ TECH.SPEC.	APPD. DRG./ DATA SHEET/ TECH.SPEC./MFG. STD.	TEST CERT.	✓	P	V	V	
		SURFACE DEFECTS	CRITICAL	DPT	100%	ASTM-E-165	NO LINEAR INDICATION	INTERNAL RECORD	✓	P	V	-	

LEGEND:

RECORDS, IDENTIFIED WITH ✓ ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

M: MANUFACTURER .
C: MAIN VENDOR, CU: BHEL/CUSTOMER
INDICATE "P" PERFORM, "W" WITNESS AND "V" VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

		STANDARD QUALITY PLAN FOR BALL VALVE					QUALITY PLAN NO.: PE-QP-XXX-166-A808 PACKAGE-FULE OIL SYSTEM PROJECT- REV.NO. 0 SHEET 3 OF 3 DATE: 31/03/2012							
SL NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY				REMARKS	
									D	M	C	CU		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2.3	BALL & SEAT	BLUE MATCH	CRITICAL	BLUE MATCHING	100%	THE SURFACE WILL BE SMOOTH & WILL HAVE UNIFORM METAL TO METAL CONTACT	SAME AS COL.7	LOG BOOK	✓	P	V	V		
3.0	<u>ASSEMBLY</u>	DIMENSIONS	MAJOR	MEASUREMENT	*AS PER NOTE-1 BELOW	APPD. DRG./ RELEVANT STD.	APPD. DRG./ RELEVANT STD.	INTERNAL RECORD	✓	P	W	W		
		OPENING & CLOSING	- DO -	OPERATION	- DO -	SMOOTH OPERATION OF VALVE	- DO -	- DO -	✓	P	W	W		
4.0	<u>TESTING:</u>													
4.1	SHELL	LEAKAGE	CRITICAL	HYDRO-STATIC	*AS PER NOTE-1 BELOW	APPD. DRG./ DATA SHEET	NO LEAKAGE	TEST CERTIFICATE	✓	P	W	W		
4.2	SEAT	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	✓	P	W	W		
4.3	SEAT	- DO -	- DO -	AIR	- DO -	- DO -	- DO -	- DO -	✓	P	W	W		
4.4	FIRE SAFE TEST REPORT WITNESSED BY LLOYD/BV SHALL BE FURNISHED FOR REVIEW													
4.5	REVIEW OF QA DOCUMENTATION AS PER APPD. QP													
5.0	<u>PAINTING:</u>	QUALITY & THICKNESS OF PAINT	MAJOR	VISUAL & MEASUREMENT	100%	TECH. SPEC./ DATA SHEET/ MFG. STD.	SAME AS COL.7	INTERNAL RECORD		P	V	-		
6.0	<u>PACKING:</u>		MAJOR	VISUAL	100%			INTERNAL RECORD		P	-	-		
NOTE-1: 100% BY MANUFACTURER 10% BY TECHNO For Actuator operating valves - Actuator test certificate shall be furnished to BHEL for review. For Fire safe valves - valves are to be accepted based on fire test certificates														
LEGEND: RECORDS, IDENTIFIED WITH ' ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER . C: MAIN VENDOR, CU: BHEL/CUSTOMER INDICATE "P" PERFORM, "W" WITNESS AND "V" VERIFICATION														
MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)					REVIEWING AGENCY (SIGN WITH DATE & STAMP)					APPROVING AGENCY (SIGN WITH DATE & STAMP)				

STANDARD QUALITY PLAN FOR CS PIPE -ERW								QUALITY PLAN NO.:PE-QP-XXX-166-A809 PACKAGE-FULE OIL SYSTEM PROJECT- REV.NO. 0 SHEET 1 OF 1 DATE: 31/03/2012						
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS	
1	2	3	4	5	6	7	8	9	D	M	C	CU	11	
1.0	ERW PIPE	a) Physical & Chemical test	M	Physical & Chemical Properties	Sample	IS:1239 Pt.1/ API 5L Gr. B/ Appd. Data sheet	IS:1239 Pt.1/ API 5L Gr. B/ Appd. Data sheet	MTC/ Mfr's TC	✓	P	V	V	Refer Note-1	
		b) Dimensional conformity	M	Measurement	At random	-do-	-do-	MTC/ Mfr's TC	✓	P	V	V		
		c) Hydro test	M	Leak test	100%	-do-	-do-	MTC/ Mfr's TC	✓	P	V	V		
Note-1: In case material is procured from dealer, and co-related Mfr's TCs are not available, check test on identified sample will be carried out at testing laboratory and hydro test at pressure 1.5 times of design pressure on 10% of total quantity will be witnessed by BHEL.														
LEGEND: RECORDS IDENTIFIED WITH " " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT. M - MANUFACTURER C - MAIN VENDOR CU - BHEL/CUSTOMER "P" PERFORM, "W" WITNESS AND V VERIFICATION														
MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)				REVIEWING AGENCY (SIGN WITH DATE & STAMP)				APPROVING AGENCY (SIGN WITH DATE & STAMP)						



STANDARD QUALITY PLAN FOR
CCS /CFS GATE,GLOBE & CHECK VALVE
(UP TO 50 NB-FCS #800 & 1 NO. 50 NB GLOBE
VALVE #600) (65 NB & ABOVE CCS # 150)

QUALITY PLAN NO.:PE-QP-XXX-166-A810

PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. 0

DATE: 31/03/2012

SHEET 1 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	N	
1	2	3	4	5	6	7	8	9	10	11	12	13	11
1	Raw Material:												
	Body, bonet, gld.,Flange, Disc, / wedge	Chem. & mech. Test Dimensions Surface quality	CR MR MR	Chem.& mech.Test Measurement Visual	Per Heat 100% 100%	Appd.Drg./ Mfg. Drg./ Data Sheet Mfg. Drg./ Data Sheet	Relevant Standard Mfg. Drg./ Data Sheet Defect Free	MTC IR IR	✓ ✓ ✓	P P P	V V V	V V V	Body will carry the heat mark for co-relation with CMT
1.1	Stem,body seat ring,gland.	Chem. & mech. Test	CR	Chem.& mech.Test	Per Heat	Appd.Drg./Relevant Std.	Appd.Drg./Relevant Std.	MTC	✓	P	V	V	
1.2	Fasteners	Chem. & mech. Test	MR	Chem.& mech.Test	Per Heat	Appd.Drg./Relevant Std.	Appd.Drg./Relevant Std.	IR	✓	P	V	V	
1.3	Gasket & gland packing	Compliance to PO	MR	Measurement	100%	Appd.Drg./Relevant Std.	Appd.Drg./Relevant Std.	IR	✓	P	V	V	
2.0	In Process Inspection												
2.1	Machining of valves components	Surface quality Dimension	MR MR	Visual Measurement	100% 100%	Mfg. Drg. Mfg. Drg.	Mfg. Drg. Mfg. Drg.	IR IR	✓ ✓	P P	V V	V V	
2.2	Spindle	Surface finish	MR	Measurement	100%	Mfg. Drg.	Mfg. Drg.	IR	✓	P	V	V	
2.3	Wedge / disc , seatring, stem & back seat	Lapping	MR	Blue Matching	100%	100% metal to metal contact	100% metal to metal contact	IR	✓	P	V	V	

LEGEND:
RECORDS IDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M MANUFACTURER/SUB-CONTRACTOR
C CONTRACTOR/NOMINATED INSPECTION AGENCY,
N CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
V VERIFICATION AS APPROPRIATE CHP
SHALL IDENTIFIED IN COLUMN "N"
IR - INSPECTION REPORT, CMT-CERTIFICATE OF MATERIAL &TEST

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)



STANDARD QUALITY PLAN FOR
CCS /CFS GATE,GLOBE & CHECK VALVE
(UP TO 50 NB-FCS #800
(65 NB & ABOVE CCS # 150)

QUALITY PLAN NO.:PE-QP-XXX-166-A810
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0
SHEET 2 OF 2
DATE: 31/03/2012

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	N	
1	2	3	4	5	6	7	8	9			10		11
3.0	Testing & Final Inspection												
3.1	Performance	Operation	CR	Manual	100%	Appd. Drg./Data Sheet	Should be smooth	IR	✓	P	W	W*	
3.2	Shell &Sheet / backseat	Pr. Testing	CR	Hyd. Testing	100%	Appd. Drg./Data Sheet	Relevant Standard / Data Sheet	CMT	✓	P	W	W*	
3.3	Seat	Pr. Testing	CR	Pneumatic Testing	100%	Appd. Drg./Data Sheet	Relevant Standard / Data Sheet	CMT	✓	P	W	W*	Not Applicable for Check Valve
3.4	Valve Assembly	1. Chk. For completeness/ Visual Inspection	MR	Visual	100%	Appd. Drg. / Tech. Spec. / Data Sheet	Appd. Drg./Data Sheet	IR	✓	P	W	W*	
		2. Dimention	MR	Measurement	10%	Appd. Drg./Data Sheet	Appd. Drg./Data Sheet	IR	✓	P	W	W*	
		3. Wear Travel / valve lift	MR	Manual	100%	Appd. Drg.	Appd. Drg.	IR	✓	P	W	W*	*RANDOM 10% BY CUSTOMER
4.0	Painting & Packaging												
		1. Painting & Packaging	MR	Manual	100%	Appd. Drg. / Tech. Spec.	Appd. Drg. / Tech. Spec.	IR		P	V		
		2. Tagging	MR	Manual	100%	Appd. Drg. / Tech. Spec.	Appd. Drg. / Tech. Spec.	PS / RS		P	V		

LEGEND:

RECORDS IDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M MANUFACTURER/SUB-CONTRACTOR

C CONTRACTOR/NOMINATED INSPECTION AGENCY,

N CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND

V VERIFICATION AS APPROPRIATE CHP

SHALL IDENTIFIED IN COLUMN "N"

IR - INSPECTION REPORT, CMT-CERTIFICATE OF MATERIAL &TEST

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)



**STANDARD QUALITY PLAN FOR
OIL STRAINER**

**QUALITY PLAN NO.:PE-QP-XXX-166-A811
PACKAGE-FULE OIL SYSTEM**

PROJECT-

REV.NO. 0 DATE: 31/03/2012
SHEET 1 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9	10				11
1.0	Raw Material												
1.1	Body, flange, dished end	Physical & Chemical Properties	MA	Physical & Chemical Test	1/Sample	Appd. Drg.	Appd. Drg./ Mfg.Std.	Mtrl.TC	✓	P	V	V	
1.2	Screen	1. Chem. composition	MA	Chem. Test	1/Sheet	- do -	- do -	- do -	✓	P	V	V	
		2. Dimension, Mesh Size	MA	Meas.	100%	- do -	- do -	log book		P	V	V	
2.0	In Process												
2.1	Welding Procedure Specification	Parameter	MA	Verification	100%	ASME-IX	ASME-IX	QW-482	✓	P	V	V	BHEL approved WPS & PQR Shall be furnished for review.
2.2	Procedure Qualification Record & Welder Qualification	Weld Soundness/ Qualification	MA	Qualification test RT	100%	ASME-IX	ASME-IX	QW-483/484	✓	P	V	V	
3.0	Weld fit up	Dimension alignment orientation	MA	Meas./ Visual	100%	Appd. WPS	Appd. WPS	log book		P	V	V	
4.0	Weldments - Final Run (all welds)	Surface Defect	MA	Penetration Test	10%	ASTME-165	No defects	- do -	✓	P	V	V	
4.1	Root run (butt welds & back gauged welds)	-do-	MA	-do-	100%	-do-	-do-	-do-	✓	P	V	V	

LEGEND:
RECORDS IDENTIFIED WITH "✓" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER
"C" MAIN VENDOR
CU - BHEL/CUSTOMER
INDICATE "P" PERFORM "W" WITNESS AND
V" VERIFICATION

**MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)**

**REVIEWING AGENCY
(SIGN WITH DATE & STAMP)**

**APPROVING AGENCY
(SIGN WITH DATE & STAMP)**



**STANDARD QUALITY PLAN FOR
OIL STRAINER**

**QUALITY PLAN NO.:PE-QP-XXX-166-A811
PACKAGE-FULE OIL SYSTEM**

PROJECT-

REV.NO. 0 DATE: 31/03/2012

SHEET 2 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9	10				11
5.0	Assembly of Internal Fittings Basket placement	Orientation Location of Tapping Points & fitting of Internals	MA	Visual & Meas.	100%	Appd. Drg.	Appd. Drg./ Mfg.Std.	log book		P	V	V	
6.0	<u>Final Assembly</u>												
6.1	Final Inspection	Completeness Cleanliness Dimension	MA	Visual & Meas.	100%	- do -	Appd. Drg./ Data Sheet	Inspection Report		P	W	W	
		Leak tightness	CR	Hyd. Test at 1.5 times of design pr. for 30 min.	100%	- do -	No leakage	Test Record	✓	P	W	W	
7.0	Review of QA Documents as per QP												

LEGEND:
RECORDS IDENTIFIED WITH "✓" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER
"C" MAIN VENDOR
CU - BHEL/CUSTOMER
INDICATE "P" PERFORM "W" WITNESS AND"
V" VERIFICATION

**MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)**

**REVIEWING AGENCY
(SIGN WITH DATE & STAMP)**

**APPROVING AGENCY
(SIGN WITH DATE & STAMP)**



**STANDARD QUALITY PLAN FOR
POSITIVE DISPLACEMENT PUMP
(SINGLE/TWIN SCREW PUMP)**

QUALITY PLAN NO.:PE-QP-XXX-166-A812

PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO.

0

DATE: 31/03/2012

SHEET

1 OF 2

SL. NO. 1	COMPONENT & OPERATIONS 2	CHARACTERISTICS 3	CLASS 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY				REMARKS 11
									D	M	C	CU	
1.0	Raw Material & Bought Out Items												
1.1	Casing, stuffing box & end cover	i) Chemical test	MA	Chemical Analysis	Sample/ heat	Appd. Data Sheet/ Appd. Drg./ IS:210 FG260	Same as Cl.7	Material TC	✓	P	V	V	
		ii) Physical test	MA	Physical Properties	Sample/ heat	- do -	Same as Cl.7	Material TC	✓	P	V	V	
		iii) Hardness	MA	Meas.	At random	As per Appd. Data Sheet	- do -	Material TC	✓	P	V	V	
1.2	Shaft, Rotor, Step-up gear, Timing gear	i) Chemical test	MA	Chemical Analysis	Sample/ heat	As per Appd. Data Sheet/ Drg.	Same as Cl.7	Material TC	✓	P	V	V	
		ii) Physical test	MA	Physical Properties	- do -	- do -	Same as Cl.7	Material TC	✓	P	V	V	
		iii) Heat treatment	MA	Heat treatment	100%	- do -	- do -	HT Chart	✓	P	V	V	
		iv) Hardness	MA	Meas.	- do -	- do -	- do -	- do -	✓	P	V	V	
1.3	Bearing	Make, size & bearing No.	MA	Visual	100%	Mfg. Drawing/ Mfg. Catalogue	- do -	Log Book		P	-	-	
2.0	In Process Control												
2.1	Machining of all Components	i) Dimension	MA	Meas.	100%	- do -	- do -	- do -		P	V	V	
		ii) Surface finish	MA	Visual	100%	- do -	- do -	- do -		P	-	-	
2.2	Casing	Pressure test	MA	Hyd. Test with water	100%	1.5 x max. discharge pr. for 15 minutes. ASTM A388	No leakage/Seepage	Test Report	✓	P	V	V	
2.3	Shaft, Rotor/Screw, Step-up gear, timing gear	1. Internal Defects	CR	UT(after skin - machining)	100%	ASTM A388	Refer Note.1 (page2)	Test Report	✓	P	V	V	
		2. Surface Defects	CR	DPT(after - final machining)	100%	ASTM E:165	No linear indication >1.6mm	Test Report	✓	P	V	V	
		3. Case Hardness of timing gear	CR	Hardness	100%	EN-36 to BS970/ As per data sheet	After case carburising, hardened & tempered to have tooth hardness of 56 to 59 HRC	H T report	✓	P	V	V	NA
2.4	Balancing of Rotor Assly.	Static & Dynamic	CR	Balancing	100%	VDI 2060 Cl. 6.3/ ISO 1940 Gr.6.3	ISO 1940 Gr.6.3	Test Report	✓	P	V	V	only in case of Twin Screw Pump

LEGEND:
RECORDS IDENTIFIED WITH ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER
"C" MAIN VENDOR
"CU" BHEL/CUSTOMER..
"P" PERFORM "W" WITNESS AND
"V" VERIFICATION

**MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)**

**REVIEWING AGENCY
(SIGN WITH DATE & STAMP)**

**APPROVING AGENCY
(SIGN WITH DATE & STAMP)**



**STANDARD QUALITY PLAN FOR
POSITIVE DISPLACEMENT PUMP
(SINGLE/TWIN SCREW PUMP)**

QUALITY PLAN NO.:PE-QP-XXX-166-A812

PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. 0
SHEET 2 OF 2

DATE: 31/03/2012

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D	AGENCY			REMARKS
										M	C	CU	
1	2	3	4	5	6	7	8	9	D	10	10	CU	11
3.0	Assembly Control Final Inspection & Testing:												
3.1	Pump Assembly	i) Completeness, correctness, overall dimension	MA	Visual & Meas.	100%	Appd. Drg.	Same as Cl.7	Log Book	✓	P	W	W	
3.2	Performance Test - with test bed motor	1.Performance for capacity, head,power consp., speed, efficiency.	CR	Performance Test	100%	VDMA/ HIS/Appd. Data sheet	Appd. Data sheet/curves/ VDMA/HIS	Test Report	✓	P	W	W	
		2. NPSHR for twin Screw pump	CR	- do -	10%	-do-	Appd. Data sheet/curves Appd. Document	- do -	✓	P	W	W	
		3. Vibration/Noise	CR	- do -	100%	Appd. Data Sheet/ Value given in Cl.8	75 micron at bearings 85 dbA measured at a distance of 1 mtr. Same as Cl.7	- do -	✓	P	W	W	Noise & vibration value measured at shop is for reference only.
		4. Relief valve set pr.	CR	- do -	100%	Appd. Data Sheet		- do -	✓	P	W	W	
3.3	Review of QA Documentation as per approved QP			-	-	-	-	-		V	V	V	
3.4	Painting	Surface Preparation & shade of painting	MA	Visual	100%	As per Mfg. Std.	Same as Cl.7	-		P	V	-	
Note: 1. Defect giving echo height more than 20% on total CRT Screen height shall be treated as unacceptable.. Defect causing reduction in backwall echo less than 80% of Screen height shall be treated as unacceptable. Frequency 2 MHz min. 2. In case of mismatch in material in QP with Data Sheet, the material indicated in approved data sheet will be final.													
LEGEND: RECORDS IDENTIFIED WITH ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT. "M" MANUFACTURER "C" MAIN VENDOR "CU" BHEL/CUSTOMER.. "P" PERFORM "W" WITNESS AND "V" VERIFICATION													
MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)				REVIEWING AGENCY (SIGN WITH DATE & STAMP)				APPROVING AGENCY (SIGN WITH DATE & STAMP)					

		STANDARD QUALITY PLAN FOR CS PIPE -SEAMLESS						QUALITY PLAN NO.:PE-QP-XXX-166-A813 PACKAGE-FULE OIL SYSTEM PROJECT- REV.NO. 0 DATE: 31/03/2012 SHEET 1 OF 1					
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
1	2	3	4	5	6	7	8	9	D	M	C	CU	11
1.0	SEAMLESS PIPE	a) Physical & Chemical test	M	Physical & Chemical Properties	Sample	ASTM A106 Gr.B/ Appd. Data sheet	ASTM A106 Gr.B/ Appd. Data sheet/ Relevant Std.	MTC/ Mfr's TC	✓	P	V	V	Refer Note-1
		b) Dimensional conformity	M	Measurement	100%	-do-	-do-	MTC/ Mfr's TC/IR	✓	P	V	V	
		c) Hydro test	M	Leak test	100%	-do-	-do-	MTC/ Mfr's TC	✓	P	V	V	
Note-1: In case material is procured from dealer, and co-related Mfr's TCs are not available, check test on identified sample will be carried out at testing laboratory and hydro test at pressure 1.5 times of design pressure on 10% of total quantity will be witnessed by BHEL													
LEGEND: RECORDS IDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT. M - MANUFACTURER C - MAIN VENDOR CU - BHEL/CUSTOMER "P" PERFORM, "W" WITNESS AND V VERIFICATION													
MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)				REVIEWING AGENCY (SIGN WITH DATE & STAMP)				APPROVING AGENCY (SIGN WITH DATE & STAMP)					



STANDARD CHECK LIST FOR OIL HOSE

CHECK LIST NO.:PE-QP-XXX-166-A816

PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. 0

SHEET 1 OF 1

REV.NO. 0

DATE: 31/03/2012

SL. NO.	COMPONENT & NO.	CHARACTERISTICS	TYPE OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
							M	C	N	
							8			
1	Material for									
1.1	Synthetic Rubber	Polymer Confirmation	Chemical Analysis	Appd.data sheet/ Relavent Code	Same as Cl.7	Lab Test Certificate	P	V	V	
1.2	Canvas	Mechanical Test	Tensile	-do-	-do-	- do -	P	V	V	
1.3	Bonding Agents	Bonding Strength	Properties	-do-	-do-	- do -	P	V	V	
1.4	End Fittings	Chem. & Mech. Test	Chem.& Mech properties	-do-	-do-	- do -	P	V	V	
2	In Process Inspection									
2.1	Compound									
	Oil Resistance	i) Oil Resistance test	Oil Resistance check	-do-	-do-	Lab Test Report	P	V	V	
		ii) Heat Resistance	Heat Resistance check	-do-	-do-	Lab Test	P	V	V	
2.2	Sheeting	i) Visual Inspection	Visual	Mfg. Drg.	Mfg. Drg.	Inspn. Report	P	-	-	
		ii) Dimension	Meas.	- do -	- do -	- do -	P	-	-	
2.3	Hose Making	i) Visual Inspection	Visual	- do -	- do -	- do -	P	-	-	
		ii) Dimensional	Meas.	- do -	- do -	- do -	P	-	-	
2.4	Wrapping	Tightening	Visual	- do -	- do -	- do -	P	-	-	
2.5	Flange	Dimension	Meas.	- do -	- do -	- do -	P	-	-	

LEGEND:

"M" MANUFACTURER/SUB-CONTRACTOR
 "C" CONTRACTOR/NOMINATED INSPECTION AGENCY,
 "N" CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
 "V" VERIFICATION AS APPROPRIATE CHP
 SHALL IDENTIFIED IN COLUMN "N"

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)



**STANDARD CHECK LIST FOR
OIL HOSE**

**CHECK LIST NO.:PE-QP-XXX-166-A816
PACKAGE-FULE OIL SYSTEM**

PROJECT-

REV.NO. 0

SHEET 1 OF 1

REV.NO. 0

DATE: 31/03/2012

SL. NO.	COMPONENT & 2	CHARACTERISTICS 3	TYPE OF CHECK 4	REFERENCE DOCUMENT 5	ACCEPTANCE NORMS 6	FORMAT OF RECORD 7	AGENCY			REMARKS 9
							M	C	N	
1							8			
2.6	Vulcanising	Complete Assembly	Hardness	Mfg.Std./Appd.Drg Appd.Data Sheet	Same as Cl.7	Inspn. Report	P	V	V	
3	Final Inspection									
	Finished Product									
	Check for completion	i) Confirmatory Test	Conformity	Appd.data sheet/ Relavent Code	- do -	T.C.	P	V	V	
		ii) Dimension (includ- ing end connection)	Measurement	Appd. Drg.	- do -	Inspn. Report	P	W	W	
		iii) Pressure Test	Hydraulic Test	Appd.data sheet/ Relavent Code	No leakage	- do -	P	W	W	
		iv) Vacuum Test	Vacuum	- do -	Same as Cl.7	- do -	P	W	W	
		v) Elongation	Measurement	- do -	- do -	- do -	P	V	V	
		vi) Electric Continuity	Elec. Cont.	- do -	- do -	- do -	P	V	V	

LEGEND:

"M" MANUFACTURER/SUB-CONTRACTOR
"C" CONTRACTOR/NOMINATED INSPECTION AGENCY.
"N" CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
"V" VERIFICATION AS APPROPRIATE CHP
SHALL IDENTIFIED IN COLUMN "N"

**MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)**

**REVIEWING AGENCY
(SIGN WITH DATE & STAMP)**

**APPROVING AGENCY
(SIGN WITH DATE & STAMP)**



STANDARD CHECK LIST
STANDARD CHECK LIST FOR: CS-FITTINGS (FORGED/SEAMLESS)
PACKAGE-FULE OIL SYSTEM
PROJECT-
CHECK LIST NO.:PE-QP-XXX-166-A817
REV.NO. 0
DATE: 31/03/2012 **Sheet 1 of 1**

SL. NO.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOCUMENT./ ACCEPTANCE NORMS	AGENCY				REMARKS
1	2	3	4	M	C	N	D	6
1	Visual and Dimensional Checks for each size and type	100% by Manufacturer and 10% by BHEL	Appd. Data Sheet/ Relevant Standard	P	W	W	✓	Inspn. Report shall be furnished
2	Check for Logo mark & Specification	-do-	-do-	P	V	V		
3	Check for TC of mother pipe/forgings	100%	-do-	P	V	V	✓	Manufacturer's TCs of mother pipe/forgings shall be furnished
4	Cross check for Mech/Chem properties of mother pipe/forging	One/Heat	-do-	P	V	V	✓	-do-

LEGEND:

RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

M= MANUFACTURER/SUB-CONTRACTOR

C= CONTRACTOR/NOMINATED INSPECTION AGENCY,

N= CUSTOMER

P= PERFORM; W= WITNESS; V= VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

**ANNEXURE-III QUALITY ASSURANCE AND INSPECTION REQUIREMENT
MISC. TANKS**

QAP OF LEVEL INDICATOR

Manufacturer's Name:			QUALITY ASSURANCE PLAN				PROJECT: PACKAGE: Misc. Tanks (Site Fabricated) LOI No. : Customer : BHEL		BHEL Doc. No.: Rev. No. : 0 Date: SHEET 1 OF 1			
			QAP OF LEVEL INDICATOR									
Sl. No.	Components and Operation	Characteristic/ Item	Class	Type of Check	Extent of Check	Reference Document	Acceptance Norm	Format of Record (D*)	Agency			Remarks
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
1	Level Indicator	Check for Type, Model No., Tag No.	MA	Visual	100%	Approved Data Sheet	Approved Data Sheet	Mfgr. TC	P	V	V	
2		Float Leakage Test	CR	Mechanical	100%	Approved Data Sheet	Approved Data Sheet	Mfgr. TC	P	V	V	
3		Review of TC for Material	CR	Visual	For Lot	MTC	MTC	Mfgr. TC	P	V	V	
		C: BHEL B : Vendor M. : Manufacturer					P - Perform W - Witness V - Verification					
Manufacturer / Contractor / Sub contractor		CR-Critical Characteristics MA - Major Characteristics MI- Minor Characteristics			FOR BHEL			FOR CUSTOMER	APRD. BY			
Signature												

Manufacturer's Name:			MANUFACTURING QUALITY PLAN FOR VALVES				PROJECT: PACKAGE: Misc. Tanks (Site Fabricated) LOI No. : Customer : BHEL		BHEL Doc. No.: Rev. No. : 0 Date: SHEET 1 OF 1				
Sl. No.	Components and Operation	Characteristic/ Item	Class	Type of Check	Quantum	Reference Document	Acceptance Norm	Format of Record (D*)	D	Agency			Remarks
										M	B	C	
1.0	Material :												
1.1	Body,Bonnet,forgings/casting	1.Chemical compositon	CR	Chem.test	One lheat	Approved Data Sheet/DRG	Relevant standard.	TC	√	P	V	V	
		2.Mech properties	CR	Tensile test	One lheat HT Batch	Approved Data Sheet/DRG	Relevant standard.	TC	√	P	V	V	
1.2	Disc & spindle	1. Mech Properties	MR	Tensile test	1 Test bar /Heat	Approved Datasheet	Relevant standard.	TC	√	P	V	V	
		Chemical properties	MR	Chemical analysis									
2.0	In Process Inspection :-												
2.1	Body,Bonnet,Disc,spindle after Machining	Visual	MR	Visual	100%		No visual surface defect	IR	√	P			
		Dimension	MR	Measurements	100%	Component drg	Component drg	compliance report					
2.2	Body,Seat ring ,Disc,spindle after Machining	Surface defects	MR	DPT	100%	ASTM A 165	No significant defects	mfrg.TC	√	P	-		
3.0	TESTING & FINAL INSPECTION												
3.1	Complete valve	hydrotesting(pressure & duration as per approved datasheet/std.)	MR	Body/seat	100%	Approved datsheet	No leakage through Body/seat	TC	√	P	W	W	
3.2		Functional test	MR	Full open & full close	100%	Approved Drg/datasheet	Smooth operation	IR	√	P	W	W	
		LEGEND : * RECORDS INDENTIFIED WITH "TICK" SHALL BE INCLUDED											
		C: BHEL B. : VENDOR M:Manufacturer DPT=Dye penetrant test MR-MAJOR.CR-Critical ,CHP-customer Hod, R=review,NDT-non Destructive test,TC-test certificate, IR-inspection Report ,D-Data folder DPT=Dye penetrant Test				P - Perform W - Witness V - Verification							
Manufacturer / Contractor / Sub contractor		CR-Critical Characteristics MA - Major Characteristics MI- Minor Characteristics				FOR BHEL		FOR CUSTOMER		APRD. BY			

QAP OF MS PLATES

Manufacturer's Name: Approved sub vendor			MANUFACTURING QUALITY PLAN				PROJECT: PACKAGE: Misc.Tanks (Site Fabricated) LOI No. : Customer : BHEL		BHEL Doc. No.: Rev. No. : 0 Date: SHEET 1 OF 1				
			ITEM: MS PLATES Sub-system- Misc.tanks										
Sl. No.	Components and Operation	Characteristic/ Item	Class	Type of Check	Extent of Check	Reference Document	Acceptance Norm	Format of Record (D*)	D	Agency			Remarks
1	2	3	4	5	6	7	8	9		M	B	C	
RAW MATERIAL													
1	STEEL PLATES	Chemical composition and Mechanical test	MA	Review of corelated MTC	one/heat	IS:2062	IS:2062	Mfgr. TC	√	P	V	V	Refer Note below
2		Visual and dimensionl check	MA	Visual and measurement	100%	Mfg.TC	Mfg.TC IS1852	Mfgr. TC	√	P	**W	**W	
3		Identification/markings	MA	Corelation establish	100%	As per manufacturing practice	As per manufacturing practice IS 2062	Mfgr. TC	√	P	V	**W	
		LEGEND : * RECORDS IDENTIFIED WITH "TICK" SHALL BE INCLUDED C: BHEL B : VENDOR M.Manufacturer								DOC. NO. : Rev No.0			
Manufacturer / Contractor / Sub contractor		CR-Critical Characteristics MA - Major Characteristics MI- Minor Characteristics		 FOR BHEL				FOR CUSTOMER		APRD. BY			
Signature													

Notes ** In case material is despatched directly from Approved sub-vendor plant/stockyard or procured from dealer against co related TC's witnessing by BHEL is waived off and material will be accepted based on MTC of approved sub vendor. In case material is procured from dealer and co related TC's are not available, check on 100% quantity of plates will be performed on sample drawn from them at NABL certified/approved laboratory for chemical & physical properties, however dimensional check shall be witnessed by BHEL.

QAP OF PIPE FITTINGS ,FLANGES & ACCESSORIES

Manufacturer's Name:		QUALITY ASSURANCE PLAN		PROJECT: PACKAGE: Misc.Tanks (Site Fabricated) LOI No. : Customer : BHEL		BHEL Doc. No.: Rev. No. : 0 Date: SHEET 1 OF 1		
		INSPECTION CHECK LIST FOR PIPE FITTINGS ,FLANGES & ACCESSORIES						
Sl. No.	Components and Operation	Class	Type of Check	Reference Document/Acceptance Norm	Agency			Remarks
					M	B	C	
1	2	3	4	5	6			7
1	Pipes Fittings,Flanges & Accessories	MI	Visual	As per Approved Data Sheet/Tech spec.	P	V	V	
2		MI	Dimensional	As per Approved Data Sheet/Tech spec.	P	V	V	
3		MI	Review of TC	As per MTC	P	V	V	
		MA	Hydro Test	As per MTC	P	V	V	
		LEGEND : * RECORDS IDENTIFIED WITH "TICK" SHALL BE INCLUDED C : CUSTOMER /BHEL B. : VENDOR M. : Manufacturer			P - Perform W - Witness V - Verification		DOC. NO. :	
Manufacturer / Contractor / Sub contractor				FOR BHEL	FOR CUSTOMER		APRD. BY	APPROVAL SEAL
Signature								