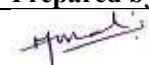
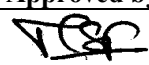


ESP-001 - 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION (Technical Specification for Knock Out Drum)	Std. / Doc. Number	
			PY 51547	
			Rev. No.	00
			Sheet 1 of 21	

Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	 R. MURALIDHAR	-Sd/- IFTEKHARUL HASSAN	 M. SIVA PRASAD BABU	19.03.19



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet 2 of 21

INDEX

S. No.	DESCRIPTION	PAGE NO.
1.0	Intent of Specification	
2.0	Special Instructions to Bidders	
3.0	Scope of Supply	
4.0	Design basis for Pressure Vessels	
5.0	Testing and Inspection requirements	
6.0	Painting Scheme	
7.0	Packing and Dispatch	
8.0	Spares	
9.0	Conflict in specification requirements	
10.0	Drawings and Documents to be submitted during Detail Engineering.	
11.0	Pre Bid clarifications and deviations	
12.0	Sub vendor list	
	Annexure 1 – P&ID for Knock Out Drum	
	Annexure 2 - Vessel datasheet	
	Annexure 3 – Typical GAD of Knock Out Drum	
	Annexure 4- Price Bid Format	
	Annexure 5- Checklist	
	Annexure 6- Pre Bid Queries Format	
	Annexure 7- Packing Details	
	Annexure 8- Master Documentation List	
	Annexure 9- Sub vendor List	
	Annexure 10- Quality Assurance Plan and Guidelines	
	Annexure 11- Deviation Format	
	Annexure 12- Painting Specification	



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **3** of **21**

Annexure 13- mandatory Spares List

DOCUMENTS TO BE SUBMITTED ALONG WITH BID:

KNOCK OUT DRUM (Pressure Vessel)

Bidder must submit the following documents along with their bid to enable BHEL to evaluate their offer.

Bidder to note that in case following documents are not submitted along with offer, the offer may be liable for Technical Rejection.

- a) **Technical Datasheet of KNOCK OUT DRUM (Annexure-2)**
- b) **Checklist for the offer (Annexure-5)**
- c) **Documents mentioned in checklist.**
- d) **Unpriced "price-bid format" (Annexure-4)**
- e) ****Deviation list [if any] as per (Annexure-11)**

**** Bidder shall submit Annexure-11 indicating as NO DEVIATION along with their offer.**
Any specific deviations, which are impractical, shall be raised in form of pre-bid queries as per Annexure-12 before submission of Techno Commercial offer.

In case the above-mentioned documents are not submitted with the offer, the offer of the bidder may be liable for technical rejection.



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet 4 of 21

1.0 INTENT OF SPECIFICATION

- 1.1 The specification is intended to cover Design, Engineering, Fabrication, Assembly & Inspection and Testing at vendor's / sub-vendor's works, painting, proper packing and forwarding, shipment & delivery at site of **Knock Out Drum(Pressure Vessel)** as per the specifications and requirements indicated in different sections of this specification.
- 1.2 Erection and Commissioning is not in the scope of bidder. However, bidder to furnish recommended Erection and Commissioning procedures along with all the drawing / documents required to facilitate Erection and Commissioning of the Skids by others.
- 1.3 The contractor shall be responsible for providing all material, equipment & services required to ensure operability, maintainability, reliability and safety of the NG Condensate Vessel as covered under this specification, irrespective of whether they have been specifically indicated in this specification or not.
- 1.4 It is not the intent to specify herein all the details of design and manufacture. However, the equipment/system 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.
- 1.5 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are hereby made part of the tender specifications. The equipment / material and works covered by their specification are subject to all the attachments referred in the specification. The tenderer shall be responsible for adherence to all requirements stipulated herein.
- 1.6 All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.
- 1.7 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 RFCL as interpreted by BHEL in the relevant context.

2.0 SPECIAL INSTRUCTIONS TO BIDDERS

- 2.1 This specification shall be read in conjunction with all its Annexures. In case of any discrepancy arising between this specification & its Annexures, the most stringent of all (as determined by purchaser) shall be followed. Further, if a requirement in this specification or any of the enclosures, calls for a decision from the Purchaser, it shall be bidder's sole responsibility to clearly bring out/highlight the same distinctively in his pre-bid queries, so as to enable purchaser to furnish their decision/clarification. If such issues/requirements are not duly addressed by bidder during the pre-bid stage and if such issues/requirements are observed later during order execution stage, it shall be binding on the bidder to comply with



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **5** of **21**

the final decision made by the purchaser subsequently, without any cost, delivery, or any other commercial implications.

- 2.2 Any additional equipment, material, services etc., which are not specifically mentioned in this specification, but required to make the NG Condensate Vessel complete in all respects, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.
- 2.3 Any specific hardware/software/item/ etc. required as indicated in 2.2. Above but not listed elsewhere in this specification or its enclosures, shall be deemed to be included in the basic price quoted by the bidder. Also, all mounting hardware/ accessories/fittings/conduits/etc. required for the Erection & Commissioning of the NG Condensate Vessel shall be deemed to be included in the basic price quoted by the bidder. Bidder, at no point of time, shall be eligible to raise any extra claim in this regard.
- 2.4 The Bidder shall accept full responsibility for the completeness and for the reliable operation of NG Condensate Vessel as a whole. These shall be executed on the basis of proven design principle. Standardization of equipment, materials etc. shall be employed in the design. Care shall be taken to ensure safe operation as well as simplicity of Erection & Commissioning of the NG Condensate Vessel. Even though, the requirements are specified in detail to the extent possible, bidder to apply good engineering practices in the design, selection of equipment, manufacturing, procurement, transportation, fabrication, painting, inspection & testing, supervision of erection & commissioning of system etc., wherever same is not clearly spelt out.
- 2.5 By accepting the contract, the bidder shall be deemed to have accepted the obligation of supplying everything that is necessary for the purpose mentioned above, regardless of any omission in the specification or on the drawings for the fulfillment of complete main plant package.
- 2.6 Bidder to note that the Purchase Order for the Scope of supply shall be placed on lump sum fixed prices based as per tender specification requirements.

Bidder to further note that they shall not be permitted for any claim for additional commercial implication on any account during the detail engineering stage.

- 2.7 Bidder shall quote strictly as per the scope of supply and requirements of this specification. Bidder offer shall be strictly as per these specification requirements. Unsolicited or alternate offers from the bidders will not be entertained.
- 2.8 In case bidder feels that it is necessary to exclude some components of scope of supply or some of the features of specification requirements due to any technical constraints, bidder shall bring the same to the notice of purchaser during pre-bid stage and take their prior approval before submission of their bid. All such clarifications required by the bidder shall be intimated to BHEL together as a single notice within a week of receipt of enquiry by bidder



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet 6 of 21

and clarifications on the same shall be obtained by the bidder from the purchaser. In case no such clarifications are sought during pre-bid stage, it will be assumed that bidder has no comments or observations on BHEL's specification and no deviations to the specifications will be taken by the bidder.

- 2.9 Bidder to quote strictly as per BHEL's Price Bid format (Annexure-4). Failure to do shall make their offer liable for rejection. Any tampering/modification/change of the BHEL's price format is not allowed and is liable for rejection of bidders offer.
- 2.10 In case Bidder is unable to offer due to any specific requirement of specification, Bidder shall bring out the same in their regret letter. Otherwise it will be considered that non participation by the bidder is attributable to reasons other than any specification requirements.
- 2.11 Compliance with this specification shall not relieve the bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.
- 2.12 The design information, specifications and drawings indicate the "Minimum" requirements and are intended to enable Bidders to ascertain the extent of the work involved. Bidders are expected to supplement the information included in this specification as required and submit a comprehensive bid.
- 2.13 The intending tenderers shall be deemed to have visited the site and have studied the conditions before submitting the Bids. Non-familiarity with the site conditions will not be considered a reason either for extra claims or for not carrying out the work in strict conformity with the drawings and specifications.
- 2.14 **The successful bidder shall furnish design calculations(in native/original format) to BHEL during detailed engineering stage for approval along with the relevant pages of authentic supporting literature e.g. Code, Hand book, National / international Standards etc. All steps including formulas and abbreviations shall be clearly shown in the calculation. All inputs / assumptions shall be indicated in the first sheet of the calculation. Calculation shall be necessarily done in SI UNITS only for the followings: -**
- 2.15 Civil works will be done by BHEL based on civil inputs furnished by the bidder during detail engineering. In case of any changes in the civil input drawing after civil work is completed, necessary prices on account of modification of the civil work shall be deducted from bidder's account.



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet 7 of 21

3.0 SCOPE OF SUPPLY:

Refer Annexure-2, Technical datasheet of Knock Out Drum (Pressure vessel)

3.1 GENERAL REQUIREMENTS:

- a) Scope of supply shall be strictly as per Annexure-1 P&ID for Knock Out Drum and Annexure-2: Technical Datasheet for Knock Out Drum(Pressure vessel)
- b) All the required connections, nozzles and accessories required for each Vessel as per Annexure-1 P&ID for Knock Out Drum and Annexure-2: Technical Datasheet for Knock Out Drum(Pressure vessel)
- ~~c) All the required piping material inside the Vessel.~~
- d) The diameter and length (T-line to T-line) for pressure vessel shall be as per Annexure-2
- e) Knock Out Drum shall be provided with supporting legs of SA 516 GR70 material.
- f) Technical details of Pressure safety valve provided on the vessel are indicated in Annexure-2: Technical Datasheet for Knock Out Drum(Pressure vessel) valve.
- g) Wherever required, nozzles shall be provided with reinforcements as per code requirements, Vendor to also check for nozzle distances, and nozzle to weld distances as per code requirements, and adhere to the same while designing the vessels.
- a) All flanges and counter flanges/blind flanges for all nozzles of Vessel connections including the fasteners (bolts, studs, nuts) and gaskets for these connections.
- b) Wherever required, nozzles shall be provided with reinforcements as per code requirements, Vendor to also check for nozzle distances, and nozzle to weld distances as per code requirements, and adhere to the same while designing the vessels.
- ~~c) Knock Out Drum shall be provided with a platform with railing. This platform is meant for approachability and accessibility of instruments. The platform shall be of minimum 1 feet width and shall be along the length of surge vessel. The platform shall be provided with a ladder also.~~
- ~~d) Knock Out Drum shall be provided with cat ladder to reach inside of the pressure vessel.~~
- ~~e) Platforms, ladders & foundation bolts are included in vendor's scope of supply.~~
- f) The MOC of Gaskets shall be SS 304 SPIRAL WOUND WITH GRAPHITE FILLER
- a) Thickness requirements and corrosion allowances shall be as per Annexure-2.



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **8** of **21**

- ~~b) Piping Material specification shall be as per Annexure-3.~~
- c) All the required manhole covers/flanges including the fasteners (bolts, studs, nuts) and gaskets.
- ~~d) All inlet lines shall be provided with diffusers to limit the velocity.~~
- ~~h) Instrumentation shall be as per Annexure-2: Technical Datasheet for Knock Out Drum(Pressure vessel)~~
- e) All anchor bolts, nuts, washers including pad plates (as required for anchoring of Vessel as per approved design calculations).
- ~~f) All the required material for draining and goose neck venting arrangements for the Vessels including necessary piping, fittings, nozzles, valves, flanges, fasteners etc.~~
- ~~g) Required material for Earthing of the Vessels up to the nearest risers of earthing mats including earthing pads, strips etc.~~
- h) All bolts/studs/nuts shall be galvanized.
- i) O&M Manuals in both soft and hard form (6 sets).
- j) Required hard copies of approved drawings/documents indicated elsewhere in this specification.
- k) Any other material required to complete the Vessels as per the intent and requirements of this specification.

3.2 SCOPE OF SERVICES:

The major scope of services shall include:

- 3.2.1 Design, engineering, preparation of detailed fabrication drawings, bill of material, tag and piece numbers, welding procedures, Erection and commissioning procedures, preventive and overhauling recommendations etc. Stiffeners and other structural framing for supporting the Vessel shall be designed by the fabricator and properly shown in the fabrication drawings.
- 3.2.2 Preparation and submission of all drawings as per Cl. No. 10.0 of this specification.
- 3.2.3 Surface preparation, Painting of Vessel (Required coats) as indicated in Technical Datasheet for Knock Out Drum(Pressure Vessel), Annexure-2 at sub vendor works.



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **9** of **21**

3.3 EXCLUSIONS:

- 3.3.1 Foundation & associated civil works are excluded from bidder's scope of work. However, foundation drawing along with loading data, anchor bolt details etc. shall be furnished by the successful bidder during detailed engineering stage.
- 3.3.2 Earthing of Vessel is not in bidders' scope. However, tank shall be provided with 2 Nos of earthing boss, strips.
- ~~3.3.3 All the instrumentation associated with the Vessel.~~

4.0 DESIGN BASIS FOR PRESSURE VESSELS:

4.1 Applicable standards:

Knock Out Drum (Pressure Vessel) shall be designed, fabricated inspected and tested as per ASME Sec. VIII Div.1.Latest revision.

4.2 Materials:

Materials to be used shall conform to Indian Standard Specification of equivalent grade.

Material of construction shall be as per Annexure-2.

NOTES:-

1. All pipes shall be of seamless construction.
2. Check for impact testing requirement as per UCS – 66 for coincident temperature and part thickness.

4.3 Minimum Wall thickness:

Shell Wall thickness shall be as Annexure-2.

~~(i) For Carbon and alloy steels:~~

~~The Minimum wall thickness shall be calculated as per code. However, it shall be cross checked as follows:~~

~~Minimum wall thickness – 6 mm (including corrosion allowance), but not less than calculated as follows:~~

~~———— (1) FOR DIA LESS THAN 2400 MM~~

~~———— Wall thk = (Dia /1000) + 1.5 + CA~~

~~———— (2) FOR DIA 2400 MM AND ABOVE~~



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **10** of **21**

~~_____ Wall thk = (Dia /1000) + 2.5 + CA~~

~~All dimensions are in mm.~~
~~(ii) For Stainless steels:~~

- ~~The Minimum wall thickness shall be calculated as per code. However same shall be cross checked as follows :~~

~~Minimum wall thickness — 3 mm, but not less than calculated as follows:~~
~~_____ (1) FOR DIA LESS THAN 1500 MM~~

~~_____ Wall thk = (Dia /1000) + 2.5~~

~~_____ All dimensions are in mm.~~
~~Corrosion allowance if any, shall be added to the minimum thickness calculated as Above.~~

4.4 Corrosion Allowance:

Minimum corrosion allowance shall be as per Annexure-2. However corrosion allowance is not applicable for stainless steel material.

4.5 Specification of Plate Materials:

(i) Carbon Steel Plates:

A) Chemical Analysis:

(a) Plates used shall conform to latest issue of SA-20 with additional requirements mentioned herein.

- Only normalized plates free from injurious defects with workmanlike finish shall be used. Reconditioning / repair of plates by welding shall not be permitted.
- One product analysis of each heat shall be carried out and reported. Chemical analysis shall be as per applicable specification with carbon content not exceeding 0.23%.
- Additionally, any of the following requirements for carbon equivalents (Ceq.) based on heat analysis shall be satisfied:

$$Ceq = C + Mn/6 \leq 0.42 \quad \text{--- (1)}$$

$$Ceq = C + MN/6 + (CR+Mo+V)/5 + (Cu + Ni)/15 \leq 0.43 \quad \text{--- (2)}$$



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **11** of **21**

Eq. 1 shall be used when applicable material specify C and Mn only.

Eq. 2 is applicable for restricted chemistry requirements or for supplementary requirements of S19 & S21 of specification SA-20.

B) Ultrasonic examination of plates

- (a) Plates having thickness 16 mm to 50 mm (both inclusive) shall be examined ultrasonically as per specification SA-435.
- (b) For quenched and tempered plates, ultrasonic examination shall be carried out after the specified heat treatment.
- (c) Charpy V-notch impact testing as per S-5 of spec. SA-20 to be carried out at design temperature for low temperature service.
- (d) Plates needed for IBR vessels shall meet the requirements of IBR.

(ii) Stainless Steel Plates/Pipes/Fittings:

A) Chemical Analysis:

- (a) All plates shall be hot rolled, annealed, pickled and shall have no.1 finish on both sides with reference to specification SA-480.
- (b) Unless otherwise specified, plates, pipes, forgings and fittings representative of each heat shall be subjected to inter granular corrosion tests as per ASTM A 262 practice E for all the 300 series material. The bend test specimen shall be examined at a magnification of 200 x.
- (c) Plates having thickness 16 mm to 50 mm (both inclusive) shall be examined ultrasonically as per specification SA-435.

4.6 Heads:

- (a) Heads shape, dimensions proposed by the manufacturer must be stated in the drawings. All carbon steel dished heads and toricones up to 16 mm thickness (nominal) shall be stress relieved and more than 16 mm thickness shall be normalized if cold pressed or formed. However, in case hot forming is carried out in the normalizing range, no stress relieving is necessary.
- (b) Cold formed dished ends of SS vessels shall not be solution annealed unless any of the following conditions exists:
 - (i) Specifically called or particular equipment/service
 - (ii) Hardness value after forming exceeds 235 BHN



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **12** of **21**

(iii) Nominal thickness of plate is 16 mm or above.

(c) Hot formed dished ends of SS vessels shall be solution annealed.

4.7 Manholes, Hand holes and nozzles:

- (a) Manholes shall be minimum 600 mm NB unless otherwise specified. If the dimension of vessel does not permit, the manhole shall be minimum of 450 mm.
- (b) Manhole cover shall be provided with a davit or hinge.
- (c) Small vessels shall be provided with two pad type inspection openings of 150 NB. If it is not possible for small vessels (up to 300 mm diameter vessel) a suitable spool pipe shall be provided in the piping for inspection.
- (d) For vessels with diameter less than 900 mm and having removable internals, shell flanges shall be provided.
- (e) As a general rule all nozzles attachment to shell/head shall be set in type.
- (f) The reinforcement for the nozzle opening shall be integral type when required by the applicable code/standards or when the thickness of vessel wall exceeds 50 mm. Self-reinforcement type nozzles 80 NB and above shall be set-in type.
- (g) All vessel nozzles shall be welded to the vessel. Screwed connections into the vessel are not acceptable.

4.8 Flanges:

- (a) All flanges shall be as per ASME B 16.5. Larger flanges not covered by 16.5 shall be ASME B 16.47. (Series B).
- (b) For nozzles 100 NB and below, only WN flanges shall be used. SO flanges may be used for nozzles above 100 mm NB for class 150 only.
- (c) Only WN flanges shall be used in H2 service, cyclic service and corrosive services and where corrosion allowance is in excess of 3 mm.
- (d) All flanges above class 150 shall be WN type.
- (e) All flanges of class 900 and above shall have gasket surfaces for RTJ.
- (f) All flanges shall be of raised face type with serrated finish unless specified otherwise. Plate flanges are not acceptable.

4.9 Inspection:

- (a) All vessels shall be offered for stage-wise as well as for final inspection in line with approved QAP.

**PROJECT ENGINEERING & SYSTEMS DIVISION**
(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **13** of **21****4.10 Pressure Testing:**

1.0 All vessels shall be hydrostatically or pneumatically tested as per the code. In order to safeguard against the risk of brittle fracture during hydrostatic test, temperature of test fluid shall meet the requirements of UG-99 of ASME Sec. VIII Div.1 and shall be preferably not less than 16 Deg. C. In case of hydro testing of SS vessels/piping, tested water must be used and chloride content should be limited to 30 ppm only.

4.11 Welding:

- (a) Please refer to clause No. 4.16 of this document , regarding welding process, procedures and qualifications.
- (b) Full penetration weld shall be employed for joining pressure parts. Where both sides are not accessible for welding, root run by tungsten inert gas process or backing strip may be used to ensure full penetration. Backing strip, if used, is to be removed after welding, wherever possible.
- (c) All root runs / Single pass welds shall be carried out by TIG Welding.
- (d) Skip and/or stitch welding on all exterior structural welds is not permitted.

4.12 Post Weld Heat Treatment:

- (a) Vessels shall be post weld heat treated wherever it is required due to service requirement or due to code requirements. Vessels shall be post weld-heat treated as a complete unit and no welding shall be permitted once post weld heat treatment is performed.
- (b) Whenever heat treatment on stainless is carried out, it shall be followed by micro etching test and IGC test as per ASTM A 262 practice E, unless otherwise specified, to ascertain suitability and effectiveness of solution annealing. The bend test specimen shall be examined at a magnification of 200 x.

4.13 Radiography / Non Destructive Testing:

- (i) The radiographic examination shall not be less than that specified in the code. However, spot radiography is the minimum requirement for all vessels.
- (ii) When spot radiography is specified, the following requirement shall supplement the requirement specified in ASME section VIII Division 1:
 - 1. All 'T' -joint shall be radio graphed.
 - 2. Minimum 5% of total weld length excluding 'T' - joint shall be radio graphed.



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **14** of **21**

3. Evaluation, tests and repair shall be as per applicable code.

- (iii) All nozzles fabricated from plate, irrespective of thickness, shall be 100% radio graphed.
- (iv) Weld seams of formed ends shall be 100% radio graphed after forming and heat treatment, if any.
- (v) The technique employed and the weld quality achieved shall meet the requirements of the code.
- (vi) All nozzles to shell welds (Root and Final run) shall be examined by magnetic particle/Dye penetrant test.

4.14 Cleaning:

- (i) Vessels shall be cleaned internally to remove scale, rust, dirt, foreign material by wire brushing.
- (ii) Stainless steel surfaces both inside and outside shall be pickled and passivated in accordance with specification ASTM-A 380 after hydrotest.

4.15 General:

- (a) Vessel shall be provided with lifting lugs, wherever required. Skirt supported vessels shall be provided with tailing lugs, if necessary.
- (b) Nozzles up to 50 mm NB size shall be stiffened with 2 number of 40 mm wide X 6 mm thick stiffeners welded at 90 degrees apart to avoid damage due to vibration during transportation.
- (c) Vessel diameter 300 mm NB and below shall be made from seamless pipe only.
- (d) Nozzle connections used for vessels shall not be less than 40 mm NB.
- (e) Rolling direction of plate for shell shall be lengthwise.
- (f) All internal nuts and bolts shall be of stainless steel construction irrespective of material of construction of vessel.
- (g) For vessels in stainless steel construction, lower allowable stress values shall be considered

4.16 WELDING PROCESS, PROCEDURES AND QUALIFICATIONS:

- a) **Welding processes:** The welding processes as defined by section IX of the ASME Boiler and Pressure Vessel (B&PV) code are acceptable.
- b) **Welding Procedure specifications:** Each manufacturer shall prepare or obtain detailed written welding procedure specifications (WPS) outlining all essential, nonessential and supplementary essential variables as required by section IX of the ASME B&PV code. Materials



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **15** of **21**

used in welding that are not classified under the ASME P-number base material grouping shall be qualified in accordance with the methods specified in section IX. It is the responsibility of the manufacturer to justify any base material and / or filler metal grouping that are not classified in section IX.

- c) **Welding Procedure Qualifications:** Each manufacturer shall qualify the procedures he intends to use in production, by producing weldments and having mechanical tests performed as required by section IX of the ASME B&PV code. Where controlled hardness is required by NACE MR-01-75, the maximum hardness of the base materials, the weld metal, and the heat affected zone may be determined on the procedure Qualification. The results of all tests shall be recorded and certified on Procedure Qualification Records (PQR) by the manufacturer to support each WPS. Qualification by one manufacturer shall not qualify a WPS for any other manufacturer.
- d) **Welder Qualifications:** Each manufacturer shall qualify all welders and welding operators employed in welding in accordance with the requirements of section IX of the ASME B&PV code. The results of all tests shall be recorded and certified on welder performance qualification (WPQ) by the manufacturer for each welder and welding operator. Qualification of individuals employed by one manufacturer shall not qualify them for employment by any other manufacturer without re-qualification.

5.0 TESTING AND INSPECTION REQUIREMENTS:

- a) As per Annexure-10 Quality Assurance Plan and Guidelines
- b) In general, for all the equipment the scope of inspection and testing shall include verification of material test certificates, mandatory tests as well as supplementary tests (wherever specified) as per the applicable code.
- ~~c) In addition to above, complete skid with filter elements & instruments installed shall be factory assembled and tested for pneumatic leak test at a pressure of 80 PSIG.~~

(The above is on the following premise: The purpose of pneumatic leak test is to ensure that there are no leakages at flange joints due to misalignment in the piping and forces due to improper assembly. Further, there is no need to test the skid at full operating pressure at vendor's works, as (i) conducting pneumatic leak test at vendor's works at high pressures is not safe, (ii) Even if leakage test is conducted at vendor's works, re-testing is required at site due to loosening of flange joints during transportation, unloading etc..).

d) Inspection agency:

BHEL/Third Party appointed by BHEL/Customer/customer's consultant. The various inspection stages will be witnessed by individual agencies (or) Group of Agencies as per above, in line with approved quality plan.

6.0 PAINTING SCHEME:



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **16** of **21**

Refer Annexure-2: Technical Datasheet for Knock Out Drum(Pressure vessel)

7.0 PACKING & DISPATCH

- 7.1 Internal piping system cleanliness to be assured by flushing or equivalent method and means provided to clean condition.
- 7.2 All material shall be delivered in a clean and usable condition. Openings shall be securely covered against entry of foreign material where appropriate.
- 7.3 Packing shall be accomplished in accordance with acceptable commercial practice (sea worthy packing for foreign dispatches) unless otherwise indicated in BHEL purchase order or quotation request. The unit shall be neatly packed and fastened, in order to avoid pilferage & damage (due to hitting of tree braches etc.,) during transportation.
- 7.4 The vendor shall make shipment using the minimum number of shipping containers consistent with requirement of safe transit.
- 7.5 In particular, the vendor shall ensure that the equipment packed are adequately protected against shock during shipment/handling.
- 7.6 Vessels shall be thoroughly dried; required preservation applied and then sealed using metal flange covers and rubber gaskets on all flanges. Preservation should be done by using desiccants, VPI powder, or by spraying the internal surface with corrosion preventive fluids, e.g. ENSIS OIL grade N (depending on what is more economical). Visible weep holes in reinforcing pads, corrosion plates, etc., shall be packed with grease. Bolts and nuts shall be coated with a suitable thread lubricant to prevent galling or corrosion. The lubricant shall be removable with mineral spirits or a solvent. Copper or molybdenum disulfide containing thread lubricants shall not be used.
- 7.7 Please refer Annex-7 for packing details.

NOTES:

- A) Loose vendor items sent by Vendors to sites shall be quantified/ numbered/ tagged and not merely mentioned as ONE lot of loose items.
- B) A packing list covering items having shelf life are to be intimated to site. Also, shelf life items shall be packed separately in black color painted box for easy identification at site.

8.0 SPARES:

- a) **Commissioning spares:**
Commissioning spares should form a part of main skid itself. Same shall be as per Price bid format **Annexure-4**.
- b) **Mandatory spares:**
Mandatory spares should form a part of main skid itself. Same shall be as per Price-bid format **Annexure-4**.

NOTE: Mandatory spares should be supplied separately with green colour painted box.

- c) **Two years operational spares:**
Bidder to furnish optional price for Two years operational spares as per **Annexure-4**.



PROJECT ENGINEERING & SYSTEMS DIVISION (Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet 17 of 21

9.0 CONFLICTS IN SPECIFICATION REQUIREMENTS:

In case of any conflict between this specification and Annexures stringent of the requirement will govern.

10.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The successful bidder shall submit as per the Master Document List enclosed vide **Annexure-8**.

10.1 Master Document List:

- a) Documentation shall be submitted by bidder during detailed engineering stage, as per the Master Document List (Annexure-8).
- b) Bidder shall ensure submission of all documentation as per approved Master Document List.
- c) Bidder to note that the dates of submission of all the documents shall be finalized by him considering the time required for approval of various documents at Purchaser's end. It shall be solely bidder's responsibility to get approval on the entire document from purchaser to meet project schedule.

10.2 Drawing approval category:

1) The master document list shall clearly identify the class of review to be performed against each document.

2) Following classes of review shall be followed for all the documents engineered by the bidder

- **APPROVAL (A)**

Approval is mandatory and bidder cannot proceed without obtaining Purchaser's approval.

- **INFORMATION / RECORDS (I)**

This type of documents shall be submitted to Purchaser for his information. Bidder can proceed if Purchaser's comments are not received within 14 working days of receipt in Purchaser's office.

However, if any deviation to contract specification for any design deficiency is detected in the course of review after stipulated period, it shall be the responsibility of the bidder to see that such deviations and deficiencies are corrected to ensure compliance to contract without any cost and time implication to purchaser

10.3 Drawings Review & Approvals:

10.3.1 Bidder to understand that efficient handling of drawings and documents to be prepared by him under the contract is the key to the timely completion of the skid package. By accepting the contract the bidder undertakes to ensure that all drawings and documents to be



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **18** of **21**

submitted by him to the Purchaser / End Customer shall be of professional quality and conforming to the contractual requirements.

- 10.3.2 Bidder to note that the dates of submission of all the documents shall be finalized by him considering the time required for approval of various documents at Purchaser's end. It shall be solely bidder's responsibility to get approval on the entire document from purchaser to meet project schedule.
- 10.3.3 Each drawing submitted by the bidder shall be clearly marked with the name of the Owner, the unit designation, the specifications, title, the specification number and the name of the Project with revision No. and date. If standards, catalogue pages are submitted the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawings shall be in English.
- 10.3.4 The approval and /or review by the Purchaser /End customer shall not be construed by the bidder as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and drawings.
- 10.3.5 The sole responsibility of the correctness of Design, Engineering shall lie with the bidder, irrespective of the fact that the Drawings / Documents submitted are reviewed or not by the Purchaser /End customer.
- 10.3.6 The bidder shall correct all faulty designs & constructions detected at any stage of work (irrespective of the fact whether drawings related to such faulty designs & or constructions are approved by purchaser), without any cost and time implication to the Purchaser.
- 10.3.7 Revisions in drawings/documents shall be clearly marked within clouds. No revision without clouding shall be recognized and the same shall not be considered reviewed and approved. All revised drawings / documents shall be associated with comments compliance report,
- 10.3.8 During detailed Engineering stage, bidder to furnish list of drawings as per Master Document format (Annexure-8).

10.4 NO. OF COPIES OF EACH DOCUMENT TO BE FURNISHED

SL NO	DESCRIPTION	NO OF COPIES/ PIECES TO BE SUBMITTED	WHEN TO SUBMIT
1	Initial drawings/documents under approval and information category.	Soft copy only	Within 2 weeks of placement of order.
2	BHEL shall furnish their observation on submitted documents	Soft copy only	Within 2 weeks of document submission.
3	Revised drawings/documents incorporating BHEL's comments.	Soft copy only	Within 1 week of receipt of commented Drawings from BHEL
4	BHEL shall furnish their observation on submitted documents	Soft copy only	Within 2 weeks of document submission.
5	Final Drawings/documents	17	Within 2 months of placement of order.



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **19** of **21**

6	Erection Documentation	5	2 Months before dispatch of equipment, The list of documents identified under master document list for erection to be furnished in 5 nos. of folders.
7	Draft O & M Manuals with out test certificates	2	2 months before the delivery date of equipment
8	Revised O & M Manuals with Test Certificates to be submitted to BHEL (Hyderabad)	17	Within one month after dispatch of equipment
9	PO status of bought out items		Status to be furnished by vendor every 15 days.
10	Final O&M Manuals in a CD	3	Within one month after dispatch of equipment

NOTES:

- 1) The above schedule for drawing approval is only indicative. Bidder to furnish a bar chart for dispatch of skid as per the agreed delivery requirement of project. This schedule also shall indicate drawing submission and approval schedules meeting the delivery schedule of the equipment. Bidder and BHEL shall put all the efforts to meet the planned schedules.
- 2) The O&M manuals shall contain the following as minimum.

- The identification details of the equipment like BHEL P.O. No., Vendor's Job Identification No., and full contact address with telephone, fax, & e-mail details.
- Brief description of the system.
- System unloading, storage, erection, startup, commissioning, shut down requirements.
- System operating and maintenance requirements.
- Operational & Environmental safety instructions.
- Final data sheets and drawings.
- O&M Manuals, ~~Catalogues of the equipment (like pump, motor, etc.)~~ & instrumentation
- Recommended 2 years operational spares.
- Test reports & certificates. The draft O&M manual can be submitted without test reports.

11.0 PRE-BID CLARIFICATIONS AND DEVIATIONS:

- a) Bidders shall comply with various requirements of this specification. It may please be noted that the requirements specified here in this specification are the standard practices being followed by the bidders. However, same things are presented in a structured form so that it can be ensured that the requirements of ultimate customer are complied with.
- b) Bidders can bring out only those deviations which are impractical to meet, for our review in pre bid clarification only.
- c) Bidders may also please note that the data sheets for, valves, instruments etc., submitted along with the offer will be considered as indicative only, as the requirements specified in the specification are standard in nature. These will not be reviewed by BHEL before award

**PROJECT ENGINEERING & SYSTEMS DIVISION**
(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.

00

Sheet **20** of **21**

of contract. Same will be reviewed during order execution stage in line with the requirements of specification and agreed deviations.

12.0 SUB VENDOR LIST:

Sub-vendor list shall be as per Annexure-9.

Note: For those items not figuring in the vendor list, bidders may follow their own sub-vendor list/reputed make with prior approval from BHEL by submitting the sub-vendor credential.

- VARIANT TABLE:**

<u>Variant</u>	<u>Item</u>	<u>Material Code</u>
01	Supply of KOD for Instrument Air	
02	Commissioning Spares of KOD	
03	Mandatory Spares of KOD	



PROJECT ENGINEERING & SYSTEMS DIVISION

(Technical Specification for Knock Out Drum)

Std. / Doc. Number

PY 51547

Rev. No.	00
----------	----

Sheet 21 of 21

RECORD OF REVISIONS

[illegible]