NEYVELI LIGNITE CORPORATION LIMITED (NLC LTD.)

2X500 MW NEYVELI NEW THERMAL POWER PROJECT (NNTPP) - TG PACKAGE

TECHNICAL SPECIFICATION
FOR

FLOW ELEMENT - ORIFICE

VOLUME IIB & III

SPECIFICATION No: **PE-TS-402-145-I 105A**

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT DIVISION
NOIDA, INDIA

1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 **Volume-I (CONDITIONS OF CONTRACT)**

This consists of four parts as below :-

Volume-IA	:	This part contains instructions to bidders for making bids to BHEL.
Volume-IB	:	This part contains general commercial conditions of the tender & includes provision that vendor is responsible for the quality of item supplied by their sub-vendors.
Volume-IC	:	This part contains special conditions of contract.
Volume-ID	:	This part contains commercial conditions for erection & commissioning site work, as applicable.

1.2 **Volume-II TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume-II which comprises of :-

Volume-IIA	:	General Technical Conditions
Volume-IIB	:	Technical Specification including Drawings, if any.

1.2.1 **Volume-IIB**

This volume is sub-divided into following sections :-

Section-A	:	This section outlines the scope of enquiry.
Section-B	:	This section provides "Project Information".
Section-C	:	This section indicates technical requirements specific to the contract, not covered in Section-D.
Section-D	:	This section comprises of technical specifications of equipments complete with data sheet A, B and C.

Data Sheet - A specifies data and other requirements pertaining to the Equipment.

Data Sheet - B Specifies data to be filled by the bidder (Data Sheet-B is contained in Volume-III).

Data Sheet - C Indicates data/documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

1.2.2 **Volume-III TECHNICAL SCHEDULES**

This volume contains technical schedules and Data Sheets-B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Document No. PE-SS-999-100-Q-002 in Volume-III.

2.0 The requirements mentioned in Section-C / Data Sheets-A of section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section-D.

PREPARED BY VM RAO, DGM (Q)	APPROVED BY : RAJIVA K SOOD, AGM & MR SDM_files labelled.doc

NEYVELI LIGNITE CORPORATION LIMITED (NLC LTD.)

2X500 MW NEYVELI NEW THERMAL POWER PROJECT (NNTPP) - TG PACKAGE

TECHNICAL SPECIFICATION
FOR

FLOW ELEMENT - ORIFICE

VOLUME II-B & III

SPECIFICATION No: **PE-TS-402-145-I 105A**

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT DIVISION
NOIDA, INDIA

PREPARED BY:	CHECKED BY:	APPROVED BY:
Rahul 14/8/14	14/8/14	14.08.14
RAHUL VARSNHEY	CHETAN MALIK	SURESH CHAND SHARMA
Sr. Engr. (C & I)	Dy. Mgr. (C & I)	Sr. Mgr. (C & I)

CONTENTS

VOL-II B

	Technical specification for **FLOW ORIFICE ASSEMBLIES** **2X500 MW NNTPP-TG PACKAGE**	SPECIFICATION NO : PE-TS-402-145-I105A VOLUME **II-B** SECTION **A** REV. NO. 00 DATE: 13.08.2014 SHEET 5 OF 49

SECTION – A

SCOPE OF ENQUIRY

	Technical specification for **FLOW ORIFICE ASSEMBLIES** **2X500 MW NNTPP-TG PACKAGE**	SPECIFICATION NO. PE-TS-402-145-I105A
		VOLUME **II-B**
		SECTION **A**
		REV. NO. 00 DATE: 13.08.2014
		SHEET 6 OF 49

SCOPE OF ENQUIRY

1. SCOPE

1.1 This specification covers the Design, Manufacture, Inspection and Testing at manufacturer's works, proper packing for transportation and delivery to site of the **Flow Orifice Assemblies** and Start-up/Commissioning spares as mentioned in different sections of this specification for **2X500 MW NEYVELI NEW THERMAL POWER PLANT (NNTPP) - TG PACKAGE**

1.2 The quality plan enclosed forms the minimum requirement but not limited to be adhered to by the bidder. Bidder to sign and stamp the same and submit along with the offer as an acceptance.

1.3 Commissioning spares as specified in Section-D shall be part of scope.

1.4 Delivery schedule for the flow orifice assemblies shall be as per Purchase Order.

1.5 Scope of supply shall be flow orifice , stub nipples, root valves, spares etc. as indicated in specification & calibration to be done(one per type) at IIT/FCRI/GOVT. approved lab..

2. GENERAL TECHNICAL INSTRUCTIONS

2.1 It is not the intent here to specify all the details of design and manufacture. However, the equipment shall conform in all respects to high standard of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to the customer / consultant, who will interpret the meaning of drawing and specification and shall be entitled to reject any component or material which in his judgment is not in full accordance herewith.

2.2 The omission of specific reference to any component / accessory necessary for proper performance of the equipments shall not relieve the supplier of the responsibility of providing such facilities to complete the supply within the quoted prices.

2.3 BHEL's / NLC's representatives shall be given access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.

2.4 The Equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and Material Dispatch Clearance Certificate (MDCC) is issued by BHEL / NLC.

SECTION – B

PROJECT INFORMATION

SALIENT FEATURES OF THE SITE & GENERAL PROJECT INFORMATION

1.1 Introduction

The project site at Neyveli has distinct location advantages, being at pit-head distance from the source of lignite supply from Mines, making it convenient for transportation of lignite by belt conveyor. Water source is readily available from the nearby mines lake. Besides, other infrastructure such as access road, railway connection etc, already exist.

1.2 Power Plant Site

The power plant site is located at Neyveli, opposite to the now defunct Fertilizer and Briquetting & Carbonization Plant, near TPS-I Expansion and TPS-II.

1.3 Project & Site Information

(i).	Owner / Purchaser	:	Neyveli Lignite Corporation Limited (NLC Ltd), Neyveli, Cuddalore District, Tamil Nadu State, India
(ii).	Consultant	:	Lahmeyer International (India) Pvt. Ltd (LII), Gurgaon, NCR, India.
(iii).	Project Title	:	2x500 MW Neyveli New Thermal Power Project (NNTPP)
(iv).	Location	:	200 kms south of Chennai and 50 kms south-west of Cuddalore
(v).	Latitude	:	11° 34′ 00″ N to 11° 35′ 00″ N
(vi).	Longitude	:	79° 26′ 00″ E to 79° 27′ 00″ E
(vii).	Elevation above MSL	:	(+) 67 m
(viii).	Nearest Railway Station	:	Neyveli,
(ix).	Nearest Sea Port	:	Chennai, at a distance of 200 km
(x).	Nearest Airport	:	Chennai, at a distance of 200 km
(xi).	Road Access/Approach to Site	:	Connected by Chennai-Thanjavur NH 45C road and state highway connecting Cuddalore – Virudhachalam via Neyveli. Both NH and state high way roads are well connected to NLC township roads. The approach road is approximately 15 kms from Chennai–Thanjavur NH – 45C road
(xii).	**Site Meteorological Data**		
	• Max ambient temperature	:	42.8° C
	• Min Ambient Temperature	:	26.9° C

• Wet bulb temp	:	29° C
• Max. Relative Humidity	:	92 % in the month of September
• Min. Relative Humidity		23 % in the month of May
• Rainfall		About 1265.7 mm annually (average)
• Wind direction		South West to North East direction
• Wind Speed		97.2 km/hr (maximum recorded) 4.3 km/hr (average wind speed)
• Seismicity		As per IS: 1893 (part 4) (Zone-II) Importance factor: 1.75.

*****

	Technical specification for **FLOW ORIFICE ASSEMBLIES** **2X500 MW NNTPP-TG PACKAGE**	SPEC NO PE-TS-394-145-I105A VOLUME **II-B** SECTION **C** REV. NO. 00 DATE: 13.08.2014 SHEET 10 OF 49

SECTION – C

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFIC TECHNICAL REQUIREMENTS

The technical requirements in this section are specific for this project and shall over-ride the specification under section-D in case of any contradiction.

1. **Bidder to note that data sheet-B as enclosed in the section-D to be filled in all respects. Quality Plan enclosed in Vol. IIB should be furnished along with tender duly signed and stamped. NO Deviation is acceptable.**

2. All the formats in Vol. III should be filled up and furnished with the bid complete in all respect. Catalogues, leaflets related with the models of Flow orifice and accessories offered must be furnished with the offer. In the absence of those, the bid would be considered incomplete and shall be liable for rejection.

3. Thickness of Orifice Plate shall be minimum 3 mm for main pipe nominal diameter upto 300 NB and minimum 6mm for nominal pipe diameter above 300 NB.

4. Material of body and trim for root valves and nipple shall be SS-316.

5. Calibration for Flow Orifice plates shall be as per BS-1042/ ISO 5167.

6. Inspection shall be carried out in line with the approved drawings / data sheets / QP and specific technical requirements.

7. One Flow Orifice of each size and type shall be tested and calibrated by the bidder at IIT/FCRI/Govt. approved laboratory within his quoted price. However, the calibration test charges shall be furnished by the bidder separately in their offer.

8. Bidder to note that any commercial implication due to change in process parameters for the flow element during contract stage as long as pipe size remain unchanged shall not be acceptable.

9. Orifice plate shall be provided with handle on which the orifice diameter, pipe diameter, pressure tap distances shall be stamped.

10. SS nameplate for Flow Orifices shall include Tag no./ KKS no./ Sl. No./ Body material/ Beta ratio/ Line size & thickness/ direction of flow.

11. Customer's specification for Flow Orifice plates is enclosed on sheet nos. 14-17 of the Technical specification.

12. Start-up & Commissioning Spares:

    Start-up and Commissioning spares are those spares, which may be required during the start-up and commissioning of the Flow Orifice Assemblies. All start-up spares, which are supplied under this contract, shall be strictly interchangeable with the parts for which they are intended for replacements.

The format for price schedule to be filled-up by the bidder is enclosed in Volume-III. The prices for Start-up and commissioning spares shall be included in the price of the main Flow Orifice Assembly. However, bidder to indicate prices for start-up and commissioning spares separately in their offer. The list of these spares required is enclosed in the section-D of this specification.

One Flow Orifice plate of each size and type shall be tested and calibrated by the bidder at customer's approved laboratory within his quoted price. However, the calibration test charges shall be furnished by the bidder separately in their offer.

Bidder to note that any commercial implication due to change in process parameters for the flow element during contract stage as long as pipe size remain unchanged shall not be acceptable.

Recommended spares:

Bidder to furnish a list of recommended spares for flow Orifice assemblies for 3 years of normal operation. BHEL/NTPC reserves the right to order the required nos. of recommended spares from the successful bidder.

13. Documentation:

(A) Along with the bids:

No separate documentation required at the time of bids except those specifically listed under Cl. No. 6.0 of Sec-D of Vol-II B.

(B) After the award of contract:

9 sets of the following documents + 5 sets of CDs to be enclosed for Approval:

a. Assembly drawing of all type of Flow Orifice assemblies complete with all accessories indicating detailed dimensions, BOM and weights.
b. Flow Orifice GA Drawings.
c. Technical Data sheet-C completely filled-up.
d. Quality Plan duly signed and stamped.
e. Bore size calculations for Flow orifices for all the conditions indicated in the data sheets.
f. Differential Pressure Vs Flow, curve for each Orifice.
g. All relevant catalogues for the models of Flow Orifice Assemblies as well as accessories finalized.
h. Bar chart to indicate the time schedule for procurement, manufacture, testing and dispatch.

(C) Final documentation:

1. Category –I & IV Approved final drawings/data sheets, – 16 sets with 6 CD-ROMS
   Bore sizing calculations, DP Vs Flow Curve for each Orifice.

2. As-built drawings – 10 sets with 4 CD-ROMS

3. Test certificates – 10 sets with 4 CD-ROMS

4. Operation & Maintenance Manuals – 18 sets with 4 CD-ROMS
   For Flow Orifice Assemblies and all the Accessories.

S.N	Feature	Minimum Requirement
3	Size	Double window up to 12" and 600 lbs rating. Full view up to 6" and 150 lbs rating.
3	Body Material	SS 316
4	Glass	Pyrex tempered glass
	Others	Rotor & wetted parts shall be bronze All accessories shall be SS316
5	Protection class	IP-65
6	Connection	Screwed up to 50 NB size Flanged ANSI 150 RF – above 50 NB size
7	Accessories	Name plates, mating flanges with gasket, bolts & nuts etc.

9.19 Flow Elements

a) Orifice Plate

Table 9.18 A

Specification for Orifice Plate

S.N	Feature	Minimum Requirement
1	Type	Concentric as per ASME PTC – 19.5 (Part III); ISA RP – 3.2, 960; BS – 1042; ISO 5167
2	Material	SS 316
3	Thickness	3 mm for main pipe diameter up to 300 mm and 6 mm for main pipe diameter above 300 mm.
3	Beta ratio	0.34 to 0.7
4	Tapping's	Flanged weld neck 3 pairs of tappings.
5	Material of Branch Pipe	Same as main pipe
6	Root Valve type	Globe
7	Root Valve material	SS 316
8	Root Valve size	1"
9	Accessories	Root valves, flanges, vent / drain hole (as required)

1. Contractor to provide Beta ratio calculation, Assembly drawings & flow vs DP curves.
2. Each orifice plate shall be provided with a handle on which the orifice diameter, pipe diameter and pressure tap distances are stamped. This information shall be so located that it can be read without removing the orifice plate from pipe line.
3. The standard primary element shall be thin plate, square-edge concentric orifice plate mounted between a pair of weld-neck type

orifice flanges with flange taps. The minimum pressure rating of flanges shall be 300 pounds ANSI. The material of the orifice plates shall be SS 316 in general. Orifice plates shall be not less than 3 mm thick for nominal pipe diameters up to and including 300 mm, and not less than 6 mm thick above 300 mm NB pipe.

4. Quadrant edge or quarter circle orifice plates shall be used for highly viscous liquids and for pipe Reynolds Number below 10,000. Conical entrance type of orifice plates shall preferably be used for very highly viscous liquids up to Reynolds Number below 250. Vent and drain holes shall be provided wherever necessary.

5. Orifice diameter shall be selected, so that d/D ratio is between 0.20 to 0.70 for gas and steam and up to 0.75 for liquids.

6. Metering orifices shall not be installed in lines less than 1 ½" (40 mm) the lines shall be blown to the 1 ½ " (40 mm) size for the meter run, keeping the d/D ratio within limits.

7. Restriction orifices and integral orifice transmitters do not require upstream or down stream straight pipe runs.

8. The orifice plate shall be supplied and fitted in conformity with ISO. When the pipe diameter is larger than the value specified in ISO, the restriction ratio will be decided by extending the specific curve externally.

9. The length of straight pipe run required for metering accuracy shall be in conformity with ISO. When it is extremely difficult to comply with the standard, a minimum straight length of 10D (D = pipe inner diameter) on the upper stream and a minimum length of 5D on the down stream shall be considered.

10. All orifice plates shall be supplied with matching flanges of material and pressure rating not less than the rating of the associated pipe system.

11. For pipeline sizes of 500 mm and less, the orifice plates shall be an integral unit comprising of carrier ring assembly, tapping arrangement on both upstream as well down stream side. For line sizes more than 500 mm, the orifice plate shall be disc type. For disc type orifice plate, suitable corner tapping arrangement on both upstream as well as down stream side shall be provided. All tapping arrangements shall be complete with a piece of impulse pipe line and a shut – off valve suitable for specified line pressure.

12. For steam applications, orifice plate shall be supplied with a pair of steam condensation chambers suitable for specified line pressure.

13. Data sheets, sizing calculation, fabrication & sheets for the elements shall be submitted for approval and finalization.

11. All air piping / tubing shall be blown clean with compressed air at 3.5 Kg/sq. cm and complete lines along with fittings must be tested for leakage with soap bubbles.
12. After installation, the control valves shall be greased at greasing nipples wherever applicable.
13. After completing the installation satisfactorily in all respect, Contractor shall perform the following tests.
    - Linearity of stem movement shall be checked at four points (inputs 25%, 50%, 75%, 100% of spring range) while rising and while falling.
    - Hysteresis shall be checked.
    - Response time shall be noted.
    - Operation of airlock relay shall be checked.
    - Operation of stay put conditions (under electrical signal failure shall be checked).
14. After testing, the valve shall be boxed up with blind gaskets at both ends to prevent entry of foreign materials and clogging of plug and seat.
15. During steam blowing / acid cleaning it may be necessary to remove the valve as a whole or in part breaking a part of top-work and reconnect the spool piece. The removal, reinstallation, dismantling and reconnection of tubing and cabling shall be in Contractor's scope of work.

13.6 Flow Elements

13.6.1 Orifice Plate

For orifice plates with flange taps Contractor's scope shall include fixing of nipple and first take-off valve, fixing and supporting condensation pot (wherever applicable) and insertion of orifice plate with suitable gaskets, nuts and bolts. For orifice plates with D, D/2 tapping, pipe welded stubs shall be available.

The general guidelines for installation of orifice plates are given below.

1. The length of the take-off nipples shall be sufficient so that the first take-off valve protrudes beyond the thermal insulation.

2. The take-off nipples shall be screwed / welded according to the design requirement.
3. The hand wheel of the take-off valves shall be so oriented that they can be operated conveniently from approach platform, ladder etc. Otherwise approach platform, ladder shall be provided.
4. For steam services, condensation pots shall be connected to the tapping point before or after first take-off valves. Utmost care shall be taken to ensure that both the condensation pots are at the same level. All necessary bracing, saddle etc. shall be fabricated and used to support the condensation pots with the main pipe.
5. Orifice plates shall be inserted with proper orientation with respect to fluid flow in line.
6. Orifice plate should only be inserted in position for checking the alignment. Thereafter, it will be withdrawn and preserved till pre-commissioning activities are over.
7. Contractor shall supply suitable gaskets while fixing the orifice plates in position.
8. The orifice bar handle, shall be so oriented that the imprints are readable unassisted from the access floor of platform.
9. Contractor shall ensure proper orientation of drain or vent holes

13.6.2 Flow Nozzle

Flow Nozzles shall normally be shop assembled in branch pipe and welded in position with main pipe. The flow nozzles shall generally have D-D/2 tapping and shall be shop assembled with take-off nipples and root valves. Contractor's scope of work shall include connecting the condensation pots (for steam services) before installation of the differential pressure instrument

13.7 Local Panels, Racks, Cubicles, Gauge Board Enclosures & Structures

Local racks, panels, gauge boards, cubicles shall be installed at specified locations. Work shall also include fabrication and installation of gauge boards, stands, mounting brackets and frames, drain headers etc. with associated painting and civil work.

1. Contractor shall erect panels / cubicles / enclosures etc. only after ensuring availability of work front.
2. The panels shall be issued from warehouse or storage yard on the same day when the actual erection is performed.
3. Panel, once uncrated, must be installed on the same day.
4. Panels supplied in packed condition, will be properly slinged for lifting. When lifting unpacked panels eye-bolts shall be used. Unpacking should be done at store or installation site only.
5. During slinging or lifting of the panel, care shall be taken not to damage the structure or any instrument / equipment mounted on the panel.

SECTION – D

- **EQUIPMENT SPECIFICATION**
- **DATA SHEETS – A & B**
- **DATA SHEETS - C**
- **QUALITY PLAN**
- **BILL OF QUANTITY (INCLUDING SPARES)**

SECTION – D

EQUIPMENT SPECIFICATION

(PES – 145 – 05)

To be followed for points pertaining to Flow Orifice Plates

	SPECIFICATION FOR FLOW MEASURING DEVICES (ORIFICE)	SPECIFICATION NO.: PES – 145 - 04	
		VOLUME II B	
		SECTION D	
		REV. NO. 04	DATE 30.08.12
		SHEET 1	OF 5

1.0 SCOPE

This specification covers the design, manufacture, calibration, inspection and testing at the manufacturer's works, proper packing for transportation and delivery to site of flow measuring devices (orifices) for use in Utility/Captive Power Station/Combined Cycle Station.

2.0 CODES AND STANDARDS

2.1 All the equipment specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 The Design and Materials used for the components shall also comply with the relevant National and International standards.

2.3 As a minimum requirement, BS 1042 / ISO 5167 standard shall be complied with for Flow Orifices & ASME SA106, SA530 shall be used for branch pipes with material carbon steel Gr B & C with thickness <= 20 mm (If Applicable).

3.0 TECHNICAL REQUIREMENTS

The orifice plates shall be used as the primary flow sensing elements. These sensing elements shall provide a safe and reliable means of creating differential pressure for use in flow measurement.

3.1 Orifice Plates

The orifice plate assemblies shall conform to the following requirements unless specified otherwise in the corresponding data sheets.

3.1.1 Type: The Orifice plates shall be of concentric type, designed and manufactured as per BS 1042 / ISO 5167. The data sheet enclosed specifies the requirements of each orifice plate assembly. The bidder shall calculate the Beta ratio and validate suitability of the selected design for the specified application, Vent holes, if required for the specified duty shall be located at the top and drain holes at the bottom of the orifice.

3.1.2 Material: The material of the Orifice plates shall be stainless steel type SS 316 unless otherwise specified.

3.1.3 Orifice Plate thickness shall be >= 3 mm (min.) for pipes having diameter <= 300 mm and shall be >=6 mm (min.) for pipes having diameter > 300 mm unless otherwise specified.

3.1.4 Assembly: Orifice plates shall be supplied as complete assemblies, along with companion flanges on both sides having proper end connection for welding on to the associated pipe at site, gaskets, nuts & bolts. The carrier ring assembly shall be supplied if specified in the data sheet. End flanges along with Counter flanges shall be provided as per requirement. Concentric Square edge orifice shall be provided with downstream beveled edge.

In case when branch pipe (as in 3.2 below) is specified in the data sheet, the orifice will be welded within the branch pipe.

Each flow orifice assembly shall be provided with minimum three pairs of pressure tapping complete with associated root valves, suitable for the service conditions. The pressure tapping shall be provided either on the carrier ring or on the companion flanges as the case may be. 2 Nos. Root Valves shall be provided for normal pressure above 40 ata.

Each orifice plate or the carrier ring assembly (as the case may be) will also be provided with a extended handle. The Tag No. and duty will be permanently marked on both the sides of this handle.

3.1.5 Flanges: The Companion flanges shall conform to ANSI B16.5. The companion flange and the carrier ring material shall be same as that of the main pipe. These shall be manufactured from forged material. Companion flanges shall be suitably rated for the specified service conditions.

3.1.6 While machining the ID to maintain an uniform internal diameter, care shall be taken to ensure the minimum thickness of the branch pipe as per IBR regulations.

3.2. Branch pipe: (If Applicable)

1. For Pipe having thickness > 20 mm (Any Material).

   The branch pipe for mounting the flow Orifice will be supplied as a free issue item by the purchaser. However the successful bidder shall collect the branch pipe from any of BHEL Units or Site, to be intimated by the purchaser during contract stage. The vendor shall be responsible for proper transportation from the above collection point, machining of the branch pipe and welding the flow orifice inside the branch pipe. Acquiring of IBR certification if required shall also be the responsibility of the successful bidder. The cost of all such activities shall be included by the bidder in the offer.

2. For Pipe having thickness <= 20 mm (Material Carbon Steel Grade B & C).

   The branch pipe shall be procured by successful bidder as per the specification number PES-145-05-A. Acquiring of IBR certification if required shall also be the responsibility of the successful bidder. The cost of all such activities shall be included by the bidder in the offer.

3. 3 While machining the ID to maintain uniform internal diameter, care shall be taken to ensure the minimum thickness of the branch pipe as per IBR regulations.

3. 4 Guarantee & Performance

The guarantee for the flow orifice assemblies shall be for 12 months continuous operation from the date of commissioning.

4.0 TESTS & INSPECTION

4.1 The equipment covered under this specification shall be subject to vendor's quality plan to be approved by the purchaser before start of manufacturing. To ensure that quality is in-built in each equipment the quality assurance system manual indicating the system followed by the vendor shall be submitted to purchaser for his review.

4.2 The quality plan forming part of this specification shall be the minimum requirements for the vendor's quality plan to be submitted with the offer. The vendor shall give at least 15 days written notice to purchaser for witnessing the tests/inspection at various stages. The expenses for all such tests/inspection shall be to manufacturer's account except for the expenses of purchaser's representatives witnessing the tests. The purchaser shall attend such tests/inspection within 15 days failing which the manufacturer may proceed with the tests which shall be deemed to have been made in purchaser's presence and shall furnish relevant test certificates to the purchaser.

4.3 One orifice plate of each type and size shall be tested and calibrated by the bidder at customer's approved laboratory, within his quoted price. Details of the calibration test i.e., type of test, equipments employed etc. shall be submitted in the bid.

4.4 Each branch pipe shall be inspected by the purchaser after the completion of machining and prior to welding of the Orifice. This test will include dimensional checks, surface smoothness checks etc. Each branch pipe of thickness <= 20 mm with pipe material Carbon Steel Gr B & C shall be inspected as per Quality Plan for Branch Pipe.

4.5 IBR certification, if required for the specified service shall be obtained by the successful bidder from the concerned authority for submission to the purchaser.

4.6 The Standard QP is included in this specification to enable bidder to understand the extent of inspection and testing requirements to execute this job. The successful bidder has to follow the agreed QP, taking care of customer requirements mentioned in Sec-C and submit QP for final approval by BHEL / Customer.

5.0 SPARES

5.1 The offer shall include a list of all the recommended spares offered, for the flow elements and accessories required for 3 years of operation, until & unless specified.

5.2 The offer shall include a list of all the commissioning spares offered, which are required for commissioning of the flow elements & accessories and the cost of which shall be included in the bidder's price.

5.3 The offer shall include a list of mandatory spares (If applicable), which is required for the guarantee period. The cost of these mandatory spares shall also be included in the price of the flow element assemblies and accessories.

5.4 The spares shall also include one set of maintenance kit including special tools, if required.

6.0 DRAWINGS & DOCUMENTS

6.1 To be furnished with the Bid:

The offer shall include the following technical documents in 5 copies each:

1. Technical data sheets for each flow element and accessories, in the proforma enclosed under Data sheet-B.
2. Catalogues/Technical literature for flow element and accessories.
3. List of installations for similar equipment supplied in Thermal Power Station applications.
4. Schedules listed under Vol. III-A duly completed with bidder's signature and seal.
5. Test & Inspection schedules.
6. Details of calibration tests i.e., type of tests, equipments employed for the testing of the flow elements, together with the name of the laboratories where these tests can be conducted.
7. The calculation of proper flow orifice bore for the process conditions indicated in the data sheet.
8. Assembly drawing of each type of flow elements with detailed dimensions, B.O.M. and weights.
9. Deviations sought by bidder, if any, from the specification.

Note: In case enquiry is raised in compliance mode, offer submission shall be as per Section A of the technical specification.

6.2 To be furnished after award of contract

6.2.1 for approval:

1. Technical data sheets for each flow element and accessories, in the proforma enclosed under Data sheet-B.
2. The calculation of proper flow orifice bore for the process conditions indicated in the data sheet.
3. Assembly drawing of each type of flow orifice complete with all accessories indicating detailed dimensions, B.O.M. and weights.
4. Detailed dimensional drawings of each flow orifice, companion flanges, carrier ring, root valves, branch pipes, pressure connections, nipples etc.
5. Installation drawings for the flow elements.
6. Differential pressure vs. flow curve for each Orifice.

6.2.2 For information:

1. Storage & commissioning instructions.
2. O&M manuals are to be supplied in 10 copies.

7.0 PACKING & MARKING

7.1 **Packing**: Each orifice plate assembly and the associated accessories shall be packed properly with adequate protection against friction, stresses, vibrations and shocks during transportation. Each packing shall have markings as per Purchase Order / Special Condition of the Contract (SCC).

7.2 **Marking**: Each flow element assembly shall be identified with the following information:

- Tag Number
- Service
- Element Material
- Beta ratio
- Line size & thickness
- Direction of flow

8.0 APPLICABLE DATA SHEET FORMS

This document shall be read with one or more of the following data sheet forms:

- Data sheet A&B for Flow Measuring Devices (Orifice) : Data sheet no. PES-145-05-DS1-0

- Data sheet C for Flow Measuring Devices (Orifice) : Data sheet no. PES-145-05-DS2-0

SECTION – D

DATA SHEETS – A & B

BHEL	**DATA SHEET FOR FLOW ELEMENTS** **2X500 MW NNTPP-TG PACKAGE**	SPECIFICATION NO.: PE-TS-402-145-I105A	
		VOLUME IIB	
		SECTION D	
		REV. NO. 00	DATE 13.08.2014
		SHEET 26 OF 49	

Tag No. : **LCA10 BP 001, LCA20 BP 001, LCA30 BP 001** Date Sheet No. PES-145-05-DS1-0

DATA SHEET – A & B

	DATA SHEET – A (TO BE FILLED UP BY PURCHASER)		DATA SHEET – B (TO BE FILLED UP BY BIDDER)
GENERAL	PROJECT	**NNTPP–2x500 MW LIGNITE FIRED UNIT AT NEYVELI**	.....
	OFFER REFERENCE	BIDDER TO SPECIFY	.....
	QUANTITY	03 PER UNIT (ONE AGAINST EACH TAG NO.)	.....
	SERVICE	**CEP A/B/C DISCHARGE FLOW**	.....
ELEMENT	MAKE : MODEL	BIDDER TO SPECIFY	.....
	TYPE	[■] ORIFICE [] NOZZLE	.....
	STANDARD	[] ASME PTC 19.5 [■] BS 1042/ISO 5167 [] OTHER	.....
	DESIGN	[■] SQ EDGE [] BEVEL EDGE [] CARRIER RING	.....
		[] SHORT RADIUS [] LONG RADIUS	.....
		[] LOW BETA [] HIGH BETA	.....
			.....
	MATERIAL	[■] SS316 [] OTHER	.....
	BETA RATIO	0.34 TO 0.7	.....
	BORE DIAMETER	BIDDER TO SPECIFY	.....
	VENT HOLE	[] YES [■] NO	.....
	DRAIN HOLE	[] YES [■] NO	.....
END CONNECTION	TYPE	[■] FLANGED [] BUTT WELD END	.....
	FLANGE TYPE	[■] WELD NECK [] SLIP ON [] THREADED	.....
	FLANGE RATING : MATERIAL	ANSI #300 : ASTM A 105	.....
	BRANCH PIPE	[] YES [■] NO	.....
	BRANCH PIPE MATERIAL	NOT APPLICABLE	.....
	TAPPING LOCATION	[] D&D/2 [] CORNER [] VENTA CONTRACTA	.....
		[■] ON FLANGE	.....
		[] ON PIPE [] ON CARRIER RING	.....
	NUMBER OF TAPPINGS	[■] 3 PAIR [] 2 PAIR [] OTHER	.....
	ROOT VALVE NUMBER : SIZE	[] 12 [] 8 [■] 6 [] 4 : [■] 15 NB [] 25 NB	.....
	ROOT VALVE MATERIAL : RATING	[] CS [] AS [■] SS 316 : ANSI # 800 (GLOBE)	.....
	NIPPLE : SIZE/MATL/RATING/QTY	15NB/SS316/SCH.80/6 NOS. ; 250mm LONG	.....
	EXPANDER : SIZE/MATL/QTY	NOT APPLICABLE	.....
PROCESS DATA	FLUID	[■] CONDENSATE [] FEED WATER	.....
		[] STEAM [] CW [] OTHER	.....
		MAX. (Pump Design) / NORMAL (VWO) / MINIMUM (Min. Recirculation)	.....
	FLOW (T/HR)	668 / 604.8 / 300	.....
	PRESSURE (KG/CM2 (A))	26.9 / 29.78 / 32.9	.....
	TEMPERATURE (DEG. C.)	47.5 / 47.5 / 46.5	.....
	DESIGN PRESS : TEMP	39 $Kg/cm^2(g)$: 55 ºC	.....
	MAX. ALLOWABLE PRESS LOSS	0.5 Kg/cm^2 at max. flow	.....
	DIFF. PRESS AT MAX FLOW	BIDDER TO SPECIFY	.....

Tag No. : **LCA10 BP 001, LCA20 BP 001, LCA30 BP 001** Date Sheet No. PES-145-05-DS1-0

DATA SHEET – A & B

	DATA SHEET – A (TO BE FILLED UP BY PURCHASER)		DATA SHEET – B (TO BE FILLED UP BY BIDDER)
PIPE LINE DATA	PIPE SIZE (OD x THK) mm PIPE MATERIAL BORE DIAMETER mm MIN. AVAILABLE STRAIGHT LENGTH UPSTREAM : DOWNSTREAM FLOW DIRECTION	273 x 9.27 SA 106 GR C BIDDER TO SPECIFY 10 D : 5 D [] HORIZONTAL [■] VERTICAL UP [] VERTICAL DOWN	....
OTHER INFORMATION	IBR CERTIFICATION TOTAL WEIGHT OF FLOW ELEMENT AND ACCESSORIES	[] REQUIRED [■] NOT REQUIRED BIDDER TO SPECIFY	....

NOTES:

1. FLOW ELEMENT ACCURACY IS REQUIRED BETWEEN 300 T/HR AND 650 T/HR.
2. RECOMMENDED RANGE IS 0 – 800 T/HR.

	DATA SHEET FOR FLOW ELEMENTS 2X500 MW NNTPP-TG PACKAGE	SPECIFICATION NO.: PE-TS-402-145-I105A		
		VOLUME	IIB	
		SECTION	D	
		REV. NO.	00	DATE 13.08.2014
		SHEET	28 OF	49

Tag No. : **LCA50 BP 001** Date Sheet No. PES-145-05-DS1-0

DATA SHEET – A & B

	DATA SHEET – A (TO BE FILLED UP BY PURCHASER)		DATA SHEET – B (TO BE FILLED UP BY BIDDER)
GENERAL	PROJECT	**NNTPP–2x500 MW LIGNITE FIRED UNIT AT NEYVELI**	.....
	OFFER REFERENCE	BIDDER TO SPECIFY	.....
	QUANTITY	ONE (1) PER UNIT	.....
	SERVICE	**CONDENSATE FLOW D/S OF GSC**	.....
			.....
			.....
ELEMENT	MAKE : MODEL	BIDDER TO SPECIFY	.....
	TYPE	[■] ORIFICE [] NOZZLE	.....
	STANDARD	[] ASME PTC 19.5 [■] BS 1042/ISO 5167 [] OTHER	.....
	DESIGN	[■] SQ EDGE [] BEVEL EDGE [] CARRIER RING	.....
		[] SHORT RADIUS [] LONG RADIUS	.....
		[] LOW BETA [] HIGH BETA	.....
	MATERIAL	[■] SS316 [] OTHER	.....
	BETA RATIO	0.34 TO 0.7	.....
	BORE DIAMETER	BIDDER TO SPECIFY	.....
	VENT HOLE	[■] YES [] NO	.....
	DRAIN HOLE	[] YES [■] NO	.....
END CONNECTION	TYPE	[■] FLANGED [] BUTT WELD END	.....
	FLANGE TYPE	[■] WELD NECK [] SLIP ON [] THREADED	.....
	FLANGE RATING : MATERIAL	ANSI #300 : ASTM A 105	.....
	BRANCH PIPE	[] YES [■] NO	.....
	BRANCH PIPE MATERIAL	NOT APPLICABLE	.....
	TAPPING LOCATION	[] D&D/2 [] CORNER [] VENTA CONTRACTA	.....
		[■] ON FLANGE	.....
		[] ON PIPE [] ON CARRIER RING	.....
	NUMBER OF TAPPINGS	[■] 3 PAIR [] 2 PAIR [] OTHER	.....
	ROOT VALVE NUMBER : SIZE	[] 12 [] 8 [■] 6 [] 4 : [■] 15 NB [] 25 NB	.....
	ROOT VALVE MATERIAL : RATING	[] CS [] AS [■] SS 316 : ANSI # 800 (GLOBE)	.....
	NIPPLE : SIZE/MATL/RATING/QTY	15NB/SS316/SCH.80/6 NOS. ; 250mm LONG	.....
	EXPANDER : SIZE/MATL/QTY	NOT APPLICABLE	.....
PROCESS DATA	FLUID	[■] CONDENSATE [] FEED WATER	.....
		[] STEAM [] CW [] OTHER	.....
		MAX. (Pump Design) / NORMAL (VWO) / MINIMUM (GSC Min. Flow)	.....
	FLOW (T/HR)	1336 / 1209.6 / 220	.....
	PRESSURE (KG/CM2 (A))	26.3 / 28.18 / 31.4	.....
	TEMPERATURE (DEG. C.)	47.9 / 47.9 / 46.9	.....
	DESIGN PRESS : TEMP	39 $Kg/cm^2(g)$: 65 ºC	.....
	MAX. ALLOWABLE PRESS LOSS	0.5 Kg/cm^2 at max. flow	.....
	DIFF. PRESS AT MAX FLOW	BIDDER TO SPECIFY	.....

Tag No. : **LCA50 BP 001**

Date Sheet No. PES-145-05-DS1-0

DATA SHEET – A & B

	DATA SHEET – A (TO BE FILLED UP BY PURCHASER)		DATA SHEET – B (TO BE FILLED UP BY BIDDER)
PIPE LINE DATA	PIPE SIZE (OD x THK) mm PIPE MATERIAL BORE DIAMETER mm MIN. AVAILABLE STRAIGHT LENGTH UPSTREAM : DOWNSTREAM FLOW DIRECTION	406.4 x 12.7 SA 106 GR B BIDDER TO SPECIFY 10 D : 5 D [■] HORIZONTAL [] VERTICAL UP [] VERTICAL DOWN	....
OTHER INFORMATION	IBR CERTIFICATION TOTAL WEIGHT OF FLOW ELEMENT AND ACCESSORIES	[] REQUIRED [■] NOT REQUIRED BIDDER TO SPECIFY	....

NOTES:

1. FLOW ELEMENT ACCURACY IS REQUIRED BETWEEN 220 T/HR AND 1250 T/HR.
2. RECOMMENDED RANGE IS 0 – 1500 T/HR.

BHEL	**DATA SHEET FOR FLOW ELEMENTS** **2X500 MW NNTPP-TG PACKAGE**	SPECIFICATION NO.: PE-TS-402-145-I105A	
		VOLUME IIB	
		SECTION D	
		REV. NO. 00	DATE 13.08.2014
		SHEET 30 OF 49	

Tag No. : **LCR41 BP 001** Date Sheet No. PES-145-05-DS1-0

DATA SHEET – A & B

	DATA SHEET – A (TO BE FILLED UP BY PURCHASER)		DATA SHEET – B (TO BE FILLED UP BY BIDDER)
GENERAL	PROJECT	**NNTPP–2x500 MW LIGNITE FIRED UNIT AT NEYVELI**	.....
	OFFER REFERENCE	BIDDER TO SPECIFY	.....
	QUANTITY	ONE (1) PER UNIT	.....
	SERVICE	**DM MAKE-UP FLOW TO HOTWELL**	.....
ELEMENT	MAKE : MODEL	BIDDER TO SPECIFY	.....
	TYPE	[■] ORIFICE [] NOZZLE	.....
	STANDARD	[] ASME PTC 19.5 [■] BS 1042/ISO 5167 [] OTHER	.....
	DESIGN	[■] SQ EDGE [] BEVEL EDGE [] CARRIER RING	.....
		[] SHORT RADIUS [] LONG RADIUS	.....
		[] LOW BETA [] HIGH BETA	.....
			.....
	MATERIAL	[■] SS316 [] OTHER	.....
	BETA RATIO	0.34 TO 0.7	.....
	BORE DIAMETER	BIDDER TO SPECIFY	.....
	VENT HOLE	[■] YES [] NO	.....
	DRAIN HOLE	[] YES [■] NO	.....
END CONNECTION	TYPE	[■] FLANGED [] BUTT WELD END	.....
	FLANGE TYPE	[■] WELD NECK [] SLIP ON [] THREADED	.....
	FLANGE RATING : MATERIAL	ANSI #150 : ASTM A 182 F304	.....
	BRANCH PIPE	[] YES [■] NO	.....
	BRANCH PIPE MATERIAL	NOT APPLICABLE	.....
	TAPPING LOCATION	[] D&D/2 [] CORNER [] VENTA CONTRACTA	.....
		[■] ON FLANGE	.....
		[] ON PIPE [] ON CARRIER RING	.....
	NUMBER OF TAPPINGS	[■] 3 PAIR [] 2 PAIR [] OTHER	.....
	ROOT VALVE NUMBER : SIZE	[] 12 [] 8 [■] 6 [] 4 : [■] 15 NB [] 25 NB	.....
	ROOT VALVE MATERIAL : RATING	[] CS [] AS [■] SS 316 : ANSI # 800 (GLOBE)	.....
	NIPPLE : SIZE/MATL/RATING/QTY	15NB/SS316/SCH.80/6 NOS. ; 250mm LONG	.....
	EXPANDER : SIZE/MATL/QTY	NOT APPLICABLE	.....
PROCESS DATA	FLUID	[] CONDENSATE [] FEED WATER	.....
		[] STEAM [] CW [■] OTHER (DM WATER)	.....
		MAX. (5% MU) / NORMAL (3% MU) / MINIMUM (1% MU)	.....
	FLOW (T/HR)	80 / 48 / 16	.....
	PRESSURE (KG/CM2 (A))	4.2 / 5.1 / 6.8	.....
	TEMPERATURE (DEG. C.)	33 / 33 / 33	.....
	DESIGN PRESS : TEMP	10 $Kg/cm^2(g)$: 50 °C	.....
	MAX. ALLOWABLE PRESS LOSS	0.3 Kg/cm^2 at max. flow	.....
	DIFF. PRESS AT MAX FLOW	BIDDER TO SPECIFY	.....

Tag No. : **LCR41 BP 001**

Date Sheet No. PES-145-05-DS1-0

DATA SHEET – A & B

DATA SHEET – A (TO BE FILLED UP BY PURCHASER)			DATA SHEET – B (TO BE FILLED UP BY BIDDER)
PIPE LINE DATA	PIPE SIZE (OD x THK) mm	114.3 x 3.05	.....
	PIPE MATERIAL	SA 312 TP 304 (ERW)	.....
	BORE DIAMETER mm	BIDDER TO SPECIFY	.....
	MIN. AVAILABLE STRAIGHT LENGTH UPSTREAM : DOWNSTREAM	10 D : 5 D	.....
	FLOW DIRECTION	[■] HORIZONTAL [] VERTICAL UP [] VERTICAL DOWN	.....
OTHER INFORMATION	IBR CERTIFICATION	[] REQUIRED [■] NOT REQUIRED	.....
	TOTAL WEIGHT OF FLOW ELEMENT AND ACCESSORIES	BIDDER TO SPECIFY	.....

NOTES:

1. FLOW ELEMENT ACCURACY IS REQUIRED BETWEEN 8 T/HR AND 50 T/HR.
2. RECOMMENDED RANGE IS 0 – 100 T/HR.

	DATA SHEET FOR FLOW ELEMENTS 2X500 MW NNTPP-TG PACKAGE	SPECIFICATION NO.: PE-TS-402-145-I105A	
		VOLUME IIB	
		SECTION D	
		REV. NO. 00	DATE 13.08.2014
		SHEET 32 OF 49	

Tag No. : **LCR 75 BP 001** Date Sheet No. PES-145-05-DS1-0

	DATA SHEET – A (TO BE FILLED UP BY PURCHASER)		DATA SHEET – B (TO BE FILLED UP BY BIDDER)
GENERAL	PROJECT	**NNTPP–2x500 MW LIGNITE FIRED UNIT AT NEYVELI**	.....
	OFFER REFERENCE	BIDDER TO SPECIFY	.....
	QUANTITY	ONE (1) (COMMON FOR STATION)	.....
	SERVICE	**DM WATER INLET TO CST FLOW**	.....
ELEMENT	MAKE : MODEL	BIDDER TO SPECIFY	.....
	TYPE	[■] ORIFICE [] NOZZLE	.....
	STANDARD	[]ASME PTC 19.5 [■] BS 1042/ISO 5167 [] OTHER	.....
	DESIGN	[■] SQ EDGE [] BEVEL EDGE [] CARRIER RING	.....
		[] SHORT RADIUS [] LONG RADIUS	.....
		[] LOW BETA [] HIGH BETA	.....
			.....
	MATERIAL	[■] SS316 [] OTHER	.....
	BETA RATIO	0.34 TO 0.7	.....
	BORE DIAMETER	BIDDER TO SPECIFY	.....
	VENT HOLE	[■] YES [] NO	.....
	DRAIN HOLE	[] YES [■] NO	.....
END CONNECTION	TYPE	[■] FLANGED [] BUTT WELD END	.....
	FLANGE TYPE	[■] WELD NECK [] SLIP ON [] THREADED	.....
	FLANGE RATING : MATERIAL	ANSI #150 : ASTM A 182 F304	.....
	BRANCH PIPE	[] YES [■] NO	.....
	BRANCH PIPE MATERIAL	NOT APPLICABLE	.....
	TAPPING LOCATION	[] D&D/2 [] CORNER [] VENTA CONTRACTA	.....
		[■] ON FLANGE	.....
		[] ON PIPE [] ON CARRIER RING	.....
	NUMBER OF TAPPINGS	[■] 3 PAIR [] 2 PAIR [] OTHER	.....
	ROOT VALVE NUMBER : SIZE	[] 12 [] 8 [■] 6 [] 4 : [■] 15 NB [] 25 NB	.....
	ROOT VALVE MATERIAL : RATING: TYPE	[] CS [] AS [■] SS 316 : ANSI # 800 (GLOBE)	.....
	NIPPLE : SIZE/MATL/RATING/QTY	15NB/SS316/SCH.80/6 NOS. ; 250mm LONG	.....
	EXPANDER : SIZE/MATL/QTY	NOT APPLICABLE	.....
PROCESS DATA	FLUID	[] CONDENSATE [] FEED WATER	.....
		[] STEAM [] CW [■] OTHER (DM WATER)	.....
		MAX. MINIMUM	.....
	FLOW (T/HR)	200 20	.....
	PRESSURE (KG/CM^2 (A))	4.6 4.5	.....
	TEMPERATURE (DEG. C.)	33 33	.....
	DESIGN PRESS : TEMP	7Kg/cm^2(g) : 50 ^oC	.....
	MAX. ALLOWABLE PRESS LOSS	0.3 Kg/cm^2 at max. flow	.....
	DIFF. PRESS AT MAX FLOW	BIDDER TO SPECIFY	.....

BHEL	**DATA SHEET FOR FLOW ELEMENTS** **2X500 MW NNTPP-TG PACKAGE**	SPECIFICATION NO.: PE-TS-402-145-I105A	
		VOLUME IIB	
		SECTION D	
		REV. NO. 00	DATE 13.08.2014
		SHEET 33 OF 49	

Tag No. : **LCR 75 BP 001**

Date Sheet No. PES-145-05-DS1-0

	DATA SHEET – A (TO BE FILLED UP BY PURCHASER)		DATA SHEET – B (TO BE FILLED UP BY BIDDER)
PIPE LINE DATA	PIPE SIZE (OD x THK) mm PIPE MATERIAL BORE DIAMETER mm MIN. AVAILABLE STRAIGHT LENGTH UPSTREAM : DOWNSTREAM FLOW DIRECTION	219.1 x 3.76 SA 312 TP 304 (ERW) BIDDER TO SPECIFY 10 D : 5 D [■] HORIZONTAL [] VERTICAL UP [] VERTICAL DOWN	....
OTHER INFORMATION	IBR CERTIFICATION TOTAL WEIGHT OF FLOW ELEMENT AND ACCESSORIES	[] REQUIRED [■] NOT REQUIRED BIDDER TO SPECIFY	....

NOTES:

1. FLOW ELEMENT ACCURACY IS REQUIRED BETWEEN 20 T/HR AND 100 T/HR.
2. RECOMMENDED RANGE IS 0 – 250 T/HR.

SECTION – D

DATA SHEETS - C

	Technical specification for **FLOW ORIFICE ASSEMBLIES** **2X500 MW NNTPP-TG PACKAGE**	SPECIFICATION NO. PE-TS-402-145-I105A VOLUME II B SECTION D REV. NO. 00 DATE: 13.08.2014 SHEET 35 OF 49

TAG No. ……. Qty..... Data Sheet No.: **PES-145-05-DS2-0**

Data Sheet C

DATA SHEET-C FOR FLOW MEASURING DEVICES (ORIFICES)
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL*	PROJECT					
	OFFER REFERENCE					
	TAG NO.	QUANTITY				
	SERVICE					
	MAKE	MODEL				
ELEMENT	TYPE					
	STANDARD					
	DESIGN					
	MATERIAL					
	BETA RATIO					
	BORE DIAMETER					
	VENT HOLE					
	DRAIN HOLE					
END CONNECTION	TYPE					
	FLANGE TYPE					
	FLANGE RATING	MATERIAL				
	BRANCH PIPE					
	BRANCH PIPE MATERIAL					
	TAPPING LOCATION					
	NUMBER OF TAPPINGS					
	ROOT VALVE NO.	SIZE				
	ROOT VALVE MATERIAL	RATING				
PROCESS DATA	FLUID					
	FLOW T/HR					
	PRESSURE ATA					
	TEMP DEG C					
	DESIGN PRESS	DESIGN TEMP				
	MAX ALLOWABLE PRESSURE LOSS					
	DIFF PRESS AT MAX FLOW					

FORM NO. PEM-6666-0

	Technical specification for **FLOW ORIFICE ASSEMBLIES** **2X500 MW NNTPP-TG PACKAGE**	SPECIFICATION NO. PE-TS-402-145-I105A VOLUME II B SECTION D REV. NO. 00 DATE: 13.08.2014 SHEET 36 OF 49

TAG No. ……. Qty..... Data Sheet No.: **PES-145-05-DS2-0**

Data Sheet C

DATA SHEET-C FOR FLOW MEASURING DEVICES (ORIFICES)
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

PIPE LINE DATA	PIPE SIZE (OD x THK) mm			
	PIPE MATERIAL			
	BORE DIAMETER mm			
	AVAILABLE STRAIGHT LENGTH			
	UPSTREAM	DOWNSTREAM		
	RESTRICTION			
	UPSTREAM	DOWNSTREAM		
	FLOW DIRECTION			
OTHER INFORMATION	IBR CERTIFICATION			
	TOTAL WEIGHT OF FLOW ELEMENT AND ACCESSORIES			

	PREPARED BY	**CHECKED BY**	**APPROVED BY**	**COMPANY SEAL**
NAME				
SIGNATURE				
DATE				

SECTION – D

QUALITY PLAN

PEM :: C&I

QUALITY PLAN
FOR
FLOW ORIFICE PLATE ASSEMBLY

QUALITY PLAN NO.:	**PE-QP-402-145-I105A**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 13.08.2014
SHEET	38 OF 49

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
1.0	**MATERIAL**											
1.1	Orifice Plate	1. Physical, Chemical properties	MA	Physical, Chemical Tests	One / Plate OR One/ Heat	AP / DS / SP	AP / DS / SP	Lab Report	3/2	---	2,1	IBR certification (if applicable) to be verified by BHEL
		2. Dimensions	MA	Measurement	100%	AP	AP	IR	3/2		1	
1.2	**Flanges** A. Forgings	Chemical,Mech Properties, UT & Heat Treatment	MA	Chem & Mech UT test	Sample	Material Spec as per ASTM A 388 for UT	ANSI B 16.34	MTC,UT cert, HT cert	3/2	---	1	
	B. Machining	Dimensions	MA	Measurement	100 %	AP / DS	AP / DS	IR	3/2	----	1	
2.0	**IN PROCESS** Machine	1. Dimension	MA	Measurement	100%	AP	AP	IR	3/2	2	2	
		2. Surface finish	MA	Visual	100%	----------	Mirror Finish	-------	3/2	2	---	
		3. Surface flaw on machined surface	MA	Penetrant test	100%	ASTM 165 / IS:3658	No surface flaw	IR / TC	3/2	2	1	
3.0	**ASSEMBLY and FINAL INSPECTION**	1. Overall dimensions	MA	Measurement	100%	AP	AP	IR	3/2	2,1,4	----	
		2. Marking, Tag no. Direction of flow	MA	Visual	100%	AP / DS	AP / DS	IR	3/2	2	1,4	
		3. Calibration	MA	Performance Test	One per type	----------	BS 1042/ ISO 5167	TC	3/2		1,4	
		4 Painting	MA	Visual	100%	SP / MS	SP / MS	IR / MR	3/2	-----	1,4	

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics; IR - Inspection Reports; TC - Test Certificates; AP – Approved Drawings/doc; DS – Data Sheet; SP – Tech. Spec.; MR- Manufacturer records; MS- Manufacturer standards; $ P - Agency Performing the Test.; W - Agency Witnessing the Test; V - Agency Verifying the Test.; 1 – BHEL; 2 - Vendor; 3 - Sub-vendor; 4- NLC/LII

PEM :: C&I

QUALITY PLAN
FOR
FLOW ORIFICE PLATE ASSEMBLY

QUALITY PLAN NO.:	**PE-QP-402-145-I105A**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 13.08.2014
SHEET	39 OF 49

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
4.0	**PACKING**	Soundness of Packing against transit damage	MA	Visual	100%	SP / MS	SP / MS	----	3/2	----	----	Refer Note 4

NOTE:

1. All test reports & dimension reports shall be verified by BHEL wherever verification is by BHEL at the time of Final Inspection.
2. Minimum 2 coats of primer paint to be applied before dispatch.
3. CALIBRATION Test to be carried out at IIT-DELHI / FCRI/GOVT. approved laboratory.
4. Sea Worthy packing, if applicable.

LEGEND: * CR - Critical characteristics IR - Inspection Reports DS – Data Sheet MR- Manufacturer records $ P - Agency Performing the Test. 1 – BHEL 4- NLC/LII
MA - Major characteristics TC - Test Certificates SP – Tech. Spec. MS- Manufacturer standards W - Agency Witnessing the Test 2 - Vendor
MI - Minor characteristics AP – Approved Drawings/doc V - Agency Verifying the Test. 3 - Sub-vendor

SECTION – D

BILL OF QUANTITY

INCLUDING

SPARES

BILL OF QUANTITY FOR FLOW ORIFICES

[A] FLOW ORIFICE ASSEMBLIES COMPLETE WITH Three (3) pairs of tappings, and ACCESSORIES, like Pressure tap-off points, Root valves, Nipples etc.

S. No.	TAG NO.	SERVICE	QTY/UNIT	TOTAL QTY
1	LCA10/20/30BP001	CEP A / B / C DISCHARGE FLOW	03	06
2	LCA50BP001	CONDENSATE FLOW D/S OF GSC	01	02
3	LCR41BP001	DM MAKE-UP FLOW TO HOTWELL	01	02
4	LCR75BP001	DM WATER INLET TO CST FLOW	01	02

[B] START-UP / COMMISSIONING SPARES FOR FLOW ORIFICE ASSEMBLIES

S.No	DESCRIPTION	TOTAL QTY / UNIT	TOTAL QTY
1	PAIR OF GASKETS FOR FLOW ORIFICES	ONE (1) PAIR WITH EACH TAG .	TWO (2) PAIR WITH EACH TAG .

NEYVELI LIGNITE CORPORATION LIMITED (NLC LTD.)

2X500 MW NEYVELI NEW THERMAL POWER PROJECT (NNTPP) - TG PACKAGE

TECHNICAL SPECIFICATION
FOR

FLOW ELEMENT - ORIFICE

VOLUME III

SPECIFICATION No: **PE-TS-402-145-I 105A**

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT DIVISION
NOIDA, INDIA

CONTENTS

VOL-III

SCHEDULE OF DRAWINGS, DATASHEETS, DOCUMENTS, CATALOGUES SUBMITTED WITH THE BID

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

	Technical specification for **FLOW ORIFICE ASSEMBLIES** **2X500 MW NNTPP-TG PACKAGE**	SPECIFICATION NO. PE-TS-402-145-I 105A
		VOLUME **III**
		SECTION
		REV. NO. 00 / DATE: 13.08.2014
		SHEET 45 OF 49

INSPECTION SCHEDULE

(PLACE & ADDRESS OF TESTING/INSPECTION AND ITS SCHEDULE DATE & DURATION IN NUMBER OF DAYS ITEM/COMPONENT WISE TO BE LISTED)

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

DEVIATION SCHEDULE

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

SCHEDULE OF UNIT PRICES

[A] FLOW ORIFICE ASSEMBLIES COMPLETE WITH Three (3) pairs of tappings, and ACCESSORIES, like Pressure tap-off points, Root valves, Nipples etc.

S. No.	TAG NO.	SERVICE	TYPE OF ASSY	Unit Price (of one complete Assy excluding calibration charges and commissioning spares Ex-Works(in Rs.)
1	LCA10BP001 LCA20BP001 LCA30BP001	CEP A / B / C DISCHARGE FLOW	ORIFICE	
2	LCA50BP001	CONDENSATE FLOW D / S OF GSC	ORIFICE	
3	LCR41BP001	DM MAKE-UP FLOW TO HOTWELL	ORIFICE	
4	LCR75BP001	DM WATER INLET TO CST FLOW	ORIFICE	

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

[B] Unit prices for Gaskets

S. No.	DESCRIPTION	For ORIFICE Tag Nos.	Unit Rate(Rs.)
1	PAIR OF GASKETS	LCA10BP001	
		LCA20BP001	
		LCA30BP001	
		LCA50BP001	
		LCR41BP001	
		LCR75BP001	

[C] Unit prices for Root Valves and Nipples

S. No.	DESCRIPTION	For ORIFICE Tag Nos.	Unit Rate(Rs.)
1	ROOT VALVES	SS 316, 15 NB, ANSI#800	
2	NIPPLE	SS 316, 15 NB, SCH 80, 250 mm LONG	

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

	Technical specification for FLOW ORIFICE ASSEMBLIES 2X500 MW NNTPP-TG PACKAGE	SPECIFICATION NO. PE-TS-402-145-I 105A VOLUME III SECTION REV NO.: 00 DATE: 13.08.2014 SHEET 49 OF 49

SCHEDULE OF PRICES

[A] FLOW ELEMENT ASSEMBLIES COMPLETE WITH THREE (3) PAIRS OF TAPPINGS, AND ACCESSORIES, LIKE PRESSURE TAP-OFF POINTS, ROOT VALVES, NIPPLES etc.

S. NO. (A)	TAG NO. (B)	SERVICE (C)	TYPE (D)	UNIT PRICE FOR EACH ASSY EXCLUDING COMMISSIONING SPARES AND CALBRATION CHARGES (Rs.) (E)	COMMISSIONING SPARE CHARGES (Rs.) (F)	CALIBRATION CHARGES(Rs.) (G)	TOTAL PRICE OF FLOW ASSY (INCLUDING COMMISSIONING SPARES AND CALIBRATION CHARGES) (Rs.) for two units (H)=2 X [(E)+(F)] + (G)
1	LCA10BP001	CEP-A DISCH FLOW	ORIFICE				
2	LCA20BP001	CEP-B DISCH FLOW	ORIFICE			NA	
3	LCA30BP001	CEP-C DISCH FLOW	ORIFICE			NA	
4	LCA50BP001	COND FLOW D/S OF GSC	ORIFICE				
5	LCR41BP001	DM MAKE-UP FLOW TO HOTWELL	ORIFICE				
6	LCR75BP001	DM WATER INLET TO CST FLOW	ORIFICE				

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL