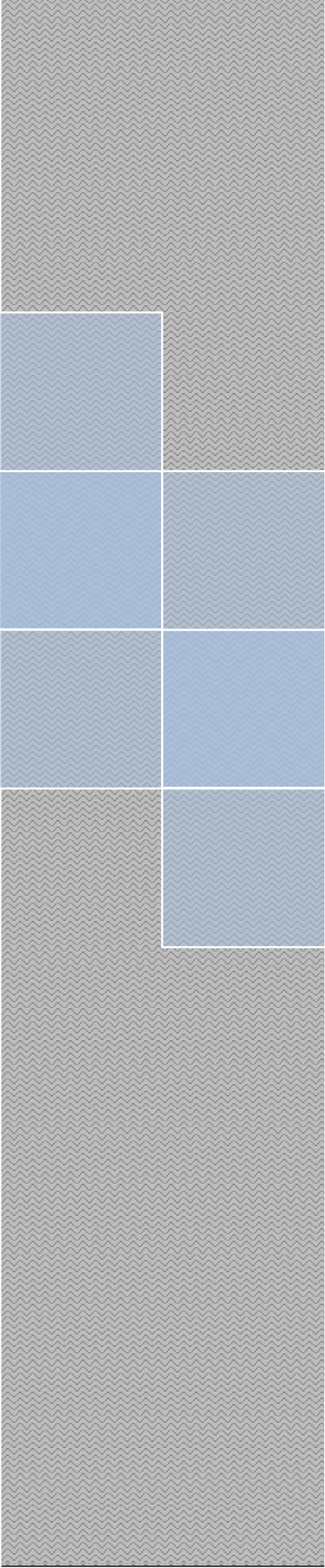




TECHNICAL CONDITIONS OF CONTRACT (TCC)

“Design, Supply and Expert Supervision for installation works of Borosilicate Glass Block Lining for 275 mtr tall single flue chimney at 1X660 MW Panki Thermal Power Plant at Panki, Kanpur, U.P.”

BHARAT HEAVY ELECTRICALS LIMITED



TECHNICAL CONDITIONS OF CONTRACT (TCC)

CONTENTS

SI No	DESCRIPTION	PAGE NO.
Volume- IA	Part-I: Contract specific details	
1	Project Information	3-4
2&3	General Scope of Works & Facilities at Site	5-9
4	Time Schedule	10
5	Terms of Payment	11
6	Execution of Work	12-13
7	Annexures	14
A	Technical Specifications	
1	TECHNICAL SPECIFICATION NO. PE-TS-426-620-C002 , Section D, Sub-section D26	09 pages
2	CHIMNEY SIZING CALCULATION, Document no. PE-DC-426-100-N318	03 page

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.0 Project Information PANKI THERMAL POWER STATION (1x660 MW)

INTRODUCTION

Panki (1X660 MW) is being set up by UTTAR PRADESH RAJYA VIDYUT UTPADAN NIGAM LIMITED (UPRVUNL) at Panki. The site is located within the premises of existing Panki Thermal Power Station, Kanpur. One (01) 660 MW supercritical unit will be installed.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/ Owner. All relevant site data / information as may be necessary shall have to be obtained / collected by the Bidder.

APPROACH TO SITE

Project Site Location:	Panki, Kanpur
Latitude & Longitude of project site:	North N 26°28'20" East E 80°14'32"
Nearest Railway Station:	Panki 5 km
Nearest Town:	Kanpur 16km
Nearest Highway:	National Highway – N.H.25
Nearest Airport:	Kanpur (25 km) & Lucknow (80 Km)
Nearest Commercial Airport:	Delhi 140 km

PROJECT INFORMATION:

Sl. No.	Title	Description
1	Owner	UTTAR PRADESH RAJYA VIDYUT UTPADAN NIGAM LIMITED (UPRVUNL), LUCKNOW
2	Project Title	Panki Thermal Power Station 1X660 MW TPS Extension
3	Project Site Location	Place – Panki, District - Kanpur State - Uttar Pradesh, Country - India
4	Land	Land is in possession of UPRVUNL
5	Location Co ordinate	26.28 N, 80.14 E
6	Site Ambient Condition	
I	Monthly mean (DBT) :	Maximum 44.4 °C : Minimum 3.8 °C
II	Extreme Recorded (DBT) :	Maximum 47.3 °C Minimum -0.9 °C
III	Monthly mean (WBT) :	Maximum – 27.3 °C, Minimum 9.2 °C
IV	Relative Humidity :	Maximum 84 % Minimum 28 %
V	Average relative humidity Annual	Average 65 %
VI	Wind Data	Basic wind speed at 10m height 47.00 m/ s As per IS: 875 part – III - 1984

TECHNICAL CONDITIONS OF CONTRACT (TCC)

		For wind resistance design of structure & equipment refer relevant civil section
VII	Seismic Zone	Zone – III As per IS: 1893, For earthquake resistance design of structure & equipment refer relevant civil section

The Nearest Town Kanpur is about 16 Km from site and is easily accessible by Road/ Railway.

Note:- The bidder is advised to visit and examine the site of WORKS and its surroundings and obtain for himself on his own responsibility all information that may be necessary for preparing the bid and entering into the CONTRACT. All costs for and associated with site visits shall be borne by the bidder.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

2.0	GENERAL SCOPE OF WORK
2.1	Scope of this tender covers “Design, Supply and Expert Supervision for installation works of Borosilicate Glass Block Lining for 275 mtr tall single flue chimney at 1X660 MW Panki Thermal Power Plant at Panki, Kanpur, U.P.”
2.2	<u>Brief Scope of Work:</u>
2.2.1	<u>Supply :</u> The scope of work includes but not limited to design, engineering, supply of material and services required for completion of the work scope as follows: A. Supply of Borosilicate Glass Block Lining system consisting of 51 mm thick closed cell glass block lining material confirming to physical & chemical properties mentioned in technical specifications, handling, storage & transportation up to CIF Mumbai (for foreign bidders) / FOR Site (for Indigenous bidder) including required epoxy primer and adhesive membranes, Mixing Machine, Special tools/ tackles and any other T&P etc. for application of borosilicate glass block lining over mild steel flue liners with adequate packing should be completed in all respects within the specified time schedule . It is bidder's responsibility to assess and supply all the material required for completion of specified scope taking into account wastages/ normal loss/ spoilages etc. unless otherwise stated. B. The 5715 square meter area indicated for application of borosilicate glass block is tentative and may vary in case of change in design/ application requirements. In case of any increase/ decrease in the area in square meters the same shall be intimated before supply of borosilicate glass block, adhesives, membranes and primer etc. and the Lump Sum Price quoted shall be adjusted in proportion to the decrease/ increase in the surface area. However, the prorata rate worked out for per square meter surface area shall be firm. The Adjustment in Lump Sum price of BOQ item no. 1 shall be made after deducting the price of Mixing Machine and Special T&P / Tools/ Tackles (If any). The price of Mixing Machine and Special T&P / Tools/ Tackles shall be considered as 1% of the total cost of BOQ item no. 1 for payment purpose. C. The bidder shall provide details of total quantities of borosilicate glass block, adhesives, membranes and primer required for installation of borosilicate glass block lining over the indicated surface area of the chimney (as per details furnished in tender specifications/ subsequent variations, if any) according to their detailed engineering. The Bidder shall submit the Billing Break-up (BBU) indicating the total quantities and Unit of Measurement for the indicated surface area for approval of BHEL. The Bidder shall also intimate the per square meter quantities of borosilicate glass, adhesives, membranes and primer required for application as per specifications. D. The payment for supplies as per approved Billing Break-up shall be released on pro rata basis for the actual quantities of borosilicate glass, adhesives, membranes and primer supplied by the bidder limited to the lump sum price for the specified surface area after considering any subsequent changes. All the required quantities of the BOQ item indicated at SI no. 1 for completion of installation of borosilicate glass lining for the surface area as per specifications/ revised specifications shall form part of the lump sum quoted price and no extra financial implication for any increase/ decrease in BBU quantities shall be admissible for payment.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

	E. In case of any increase/ decrease in the quantities for the specified area, the bidder shall be responsible for its supply without any price implication within the indicated supply schedule. F. The Manufacturer/ supplier shall also provide ten (10) year of full replacement guarantee for the system, and bear the cost of replacement, supply, installation all complete, if the lining system deteriorates or fails to protect the chimney flue liner. G. Supply of special T&Ps (as mentioned in clause 2.6.7) exclusively required for installation of Borosilicate Glass Block lining system shall also be in the scope of vendor. Nominal adhesive/ membrane thickness shall be minimum 3 mm behind & between each block. A 1.5 mm thick layer should be troweled onto the MS liner as well as to the sides and back of each block before installation H. <u>No extra payment shall be made for special T&Ps required for application of borosilicate glass block lining system over mild steel flue liners.</u>
2.2.2	<u>Expert Supervision:</u> A. Expert Supervision and technical support shall be provided by bidder during INSTALLATION of Boro-Silicate glass block lining system inside MS flue cans. The Bidder shall demonstrate the application methodology to the Purchaser and its erection agency with a view to ensure its installation as per the specifications and guaranteed parameters. The installation of Borosilicate Glass Lining Blocks, mixing of two components adhesive membrane by automatic mixing machine etc. shall be executed by erection agency of Purchaser under the expert supervision of Bidder/ Seller. B. Any defect/ non-conformity which may have potential impact on the guaranteed parameters shall be pointed out and cleared by the supervising experts after rectification by the erection agency. Once, the borosilicate glass block lining is installed under the supervision of the Experts deputed by the Bidder and protocol of completion of installation is jointly signed, Seller shall be under obligation of Guarantee in line with Clause 8.0 of the SCC and 2.2.1 (F) of TCC. C. Number of supervisors to be deployed and period of deployment should be as per site requirement duly agreed with BHEL. D. Representatives to co-operate with other agencies at site and coordinate in association with BHEL and customer's engineers at site. E. All travelling expenses / Visa fees / Medical fees to be borne by bidder. F. Representative to follow the Health, Safety and Environment (HSE) regulations in force at project under the scope of bidder. G. Working Hours: To work under local site applicable requirements. No overtime payable. The Man days for payment purpose shall be calculated from the day when bidder reports at site for commencement of borosilicate execution work. H. Medical: Vendor to arrange for medical insurance coverage for their representative.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

	I. Deployment Schedule: Deployment needs to be planned in phased manner depending upon the progress at Panki site. Further review meetings shall be held at site to discuss work progress and deployment program. J. Personnel deputed to site shall be an expert in their field / responsible for direct supervision / execution of field activities. They should be able to interact with their parent division at their HQ for trouble shooting operations / Engg. Clarifications etc. K. Visits as indicated shall be required for deputation. Expert to complete assignment for each phase / visit as per BHEL's requirement. In case of site non-readiness / mutual agreement with construction manager / BHEL, the deputation programme shall be mutually discussed and agreed upon. L. Vendor to indicate their check list with detailed activity network with recommended manpower along with general tool and plants needed for site readiness for deputation of their personnel. M. Project Management meetings shall take place at BHEL – PSNR Panki site office before start of deputation and during course of execution (as per requirement). Responsible representatives from vendor shall attend these meetings on BHEL's call. N. Protocols for applying / erection of Borosilicate shall be signed by vendor's representative at BHEL Panki site. O. Vendor's representative at site shall be under the administrative control of construction manager / BHEL Panki site. P. Vendor representative at site shall co-ordinate for their materials availability at site / report shortage / discrepancies of materials and associate himself for coordination / compressing of application / erection of Borosilicate schedule. Q. All out efforts are to be made by both parties to complete site works within the most reasonable time/ earliest possible. R. Payment shall be made for visit of vendor representative as per the time count start from reporting at site, leaving to site with the time sheet verification by construction manager / BHEL Panki site for actual number of man-days utilized and satisfactory completion of works at site. S. Payment shall be released by BHEL on monthly basis against invoices raised by vendor to BHEL PANKI site with certified time sheets. All payment will be in Indian Rupees (INR) / USD only. T. Supply of special tools requirements must be ensured by vendor. U. Under force majeure conditions applicable to BHEL engineers, vendor's experts are to be repatriated by vendor at his own cost. V. All misc. Expenses required by vendor's representative at Panki site are to be borne by vendor itself
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TECHNICAL CONDITIONS OF CONTRACT (TCC)

	W. Rates quoted / agreed shall remain firm till the completion of contract. X. Expected period of supervision for applying / erection of Borosilicate shall be for 80 days. Note: The installation of Borosilicate Glass Lining Blocks, mixing of two components adhesive membrane by automatic mixing machine etc. all complete shall be executed by erection agency under the expert supervision of Borosilicate Glass Lining Blocks manufacturer / supplier.
2.3	The Customer / Consultant “(UPRVUNL / NTPC)” and “BHEL” may depute their representative for checking and supervision of important stages of work. The bidder shall be required to provide all facilities for inspection of works at no extra cost to BHEL. Any defect in quality of work or deviations from drawings / specifications pointed out during such inspection shall be made good by the bidder in the same way as if pointed out by the BHEL Engineer, without any cost implication to BHEL.
2.4	The work under this contract shall be carried out as per BOQ Cum Rate Schedule attached as Annexure-A. The description / specifications as per BOQ (Bill of Quantities) shall be read along with technical specifications. Quantities mentioned in the BOQ cum Rate schedule are approximate only and liable for variation due to change of scope of work / variation in schedule of quantities, changes in design etc. The rate quoted by the bidder for the individual item of BOQs shall remain firm irrespective of any variation in quantities. The tenderers shall undertake to execute actual quantities required for completion of works as per advice of BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually executed and payments will also be regulated for the same. The quantities indicated against each item may vary to any extent and no compensation will be payable in variation of Individual quantity.
2.5	Any activity which is necessarily required for satisfactory execution of any item of BOQ in line with technical specifications shall be deemed to be included in BOQ item even if it is not described in the item description and no extra payment shall be made against such activity.
2.6	Bidder 's scope also includes following:
2.6.1	Bidder will work in close coordination with Customer / Consultant / BHEL Engineering Representative. The Customer / Consultant / BHEL Representative is authorized to sign off and verify that supply has been performed in accordance with Customer / Consultant / BHEL design documents and drawings.
2.6.2	Bidder shall coordinate all Work with the erection contractor and Customer / Consultant / BHEL Work Force to ensure maximum efficiency and safety.
2.6.3	Bidder shall perform all interrelated collateral and incidental Work required, but not specifically covered elsewhere to produce the desired intention of this Contract. The intended final result of this project is a sealed chimney liner in which neither flue gas nor moisture can escape in the chimney annulus space.
2.6.4	Bidder shall supply daily project monitoring, inspection reports, other project documentation.
2.6.5	Drawings and additional information pertinent to the work are in the scope of bidder.
2.6.6	For Supervision Work: The schedule of execution of work for required supervision services shall be intimated by BHEL. Normal working shall be 06 days per week.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

2.6.7	Special T&Ps 1. Mixing Machine: In order to ensure consistent, high quality mixing of the components of the lining system adhesive, (an) automated mixing machine(s) shall be provided with a min. 3,200 W mixer motor and fail-safe protection against the operator error of mixing the main adhesive component without its hardener. The mixing machine SHALL be CE – approved. The mixing machine MUST have thermal motor protection to minimize failure and fire risk. 2. Bidder shall provide all special equipment, tools and instruments required for handling and storage, and for test and maintenance of borosilicate lining system provided under this Contract. Any special tools/ tackles, machinery required to maintain the controlled environment during installation of borosilicate glass block shall be in the scope of bidder. 3. The Supply of Mixing machine, special tools/ tackles etc. shall also be completed along with Borosilicate Glass Block Lining materials in line with the Time schedule specified under Clause No 4.1 of TCC. All the supplies made including Mixing machine, Special Tool/ Tackles etc. shall be property of BHEL. Two year Guarantee/ Warranty from the date of commissioning of mixing machine shall be bidder's responsibility. All spares (if any) required during the Guarantee/ Warranty period shall be in scope supply of bidder.
3.0	Facilities at site
3.1	1. Storage of Borosilicate Glass Block Lining System and Adhesives are in the scope of BHEL free of charge. 2. BHEL will provide only work cabin within BHEL site office.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

4.0	TIME SCHEDULE
4.1	SUPPLY: <u>For Foreign Bidder:</u> The Borosilicate Glass Block lining material should be dispatched within 05 months from the date of issuance of PO so as to reach at Mumbai Port within 06 months from the date of PO. The date of on Board Marine Bill of Lading shall be considered <i>the date of dispatch</i> for levying LD in line with the provisions of SCC clause no. 10.1. The shipping company's intimation regarding arrival of ship at destination port shall be considered the <i>date of receipt of goods</i> at the Destination port. <u>For Indigenous Bidder:</u> The Borosilicate Glass Block lining material should be dispatched within 06 months from the date of issuance of PO so as to reach at Panki Site within 10 days from the date of dispatch. The date of LR/ GR/ RR shall be considered the date of dispatch for levying LD in line with the provisions of SCC clause no. 10.1. The date of delivery of Goods at Panki Site shall be considered the date of arrival of goods which should not be more than 10 days from the date of GR/ LR/ RR. Note: The Bidder (Foreign / Indigenous) shall <i>dispatch the Borosilicate Glass Block lining materials only after issuance of Material Dispatch Clearance Certificate (MDCC) by BHEL. MDCC shall be issued by BHEL within one month of submission of Material Test Certificate.</i>
4.2	SUPERVISION: Expert Supervision for installation works of Borosilicate Glass Block Lining Schedule of supervision works shall be intimated by BHEL Construction Manager separately, in advance as per actual site requirement. Bidder/ Seller shall arrange for deputation of supervisors within 2 weeks of BHEL intimation. Adequate number of supervisors shall be deployed by bidder at a time to meet the requirement for supervision of installation works of borosilicate glass block lining at Site.
4.3	The work under the scope of this contract is deemed to be completed in all respects, only when all the works are carried out as per satisfaction of BHEL. The decision of BHEL on completion date shall be final and binding on the contractor.
4.4	In order to meet above schedule in general, and any other intermediate targets set, to meet customer/ project schedule requirements, bidder shall arrange & augment all necessary resources from time to time on the instructions of BHEL without any extra cost to BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

5.0	TERMS OF PAYMENT
5.1	PAYMENT TERMS: 1. For supply of Borosilicate Glass Block Lining at CIF Mumbai: As per Clause 6.0 of SCC. 2. For Expert Supervision of Borosilicate Glass Block Lining system: Payment shall be made monthly on the basis of consumed man-days certified by BHEL Engineer In Charge at Site.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

6.1	EXECUTION OF WORK
6.1.1	The work shall be executed in a workman like manner and to the entire satisfaction of BHEL Engineer and as per technical specification issued with tender. In case of conflict, the decision of BHEL Engineer shall be final & binding.
6.2	DISCREPANCIES AND ADJUSTMENT OF ERRORS
6.2.1	In case of discrepancies between schedules of quantities, the specification and / or the drawings, the following order of preference shall be observed. (a) Description in BOQ cum Rate Schedule. (b) Technical and Conditions of Contract. (c) Special Conditions of Contract. (d) General conditions of Contract.
6.2.2	If there are varying or conflicting provisions made in any one document forming part of the contract, the BHEL Engineer shall be final deciding authority with regard to the document.
6.3	PROGRESS REPORTING :
6.3.1	Manufacturer / authorized Supplier of OEM is required to draw mutually agreed monthly program in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.
6.3.2	The progress report shall indicate the progress achieved against planned, with reasons indicating delays, if any, and shall give the remedial actions which the MANUFACTURER / SUPPLIER of OEM intends to take to make good the slippage or lost time, so that further works again proceed as per the original program and the slippages do not accumulate and effect the over all program.
6.4	DRAWING AND DOCUMENTS
6.4.1	The detailed drawings, specifications available with BHEL engineers will form part of this tender specification. These documents will be made available to the contractor during execution of work at site. The contractor will also ensure availability of all drawings/ documents at work place.
6.4.2	The data furnished in various annexures enclosed with this tender specification are only approximate and for guidance. However, the change in the design and in the quantity may occur as is usual in any such large scale of work.
6.4.3	Any error or ambiguity be discovered in the specification or information the supplier shall forthwith bring the same to the notice of BHEL before commencement of work. BHEL's interpretation in such cases shall be final and binding on the contractor.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

6.4.4	Deviation from design dimensions should not exceed permissible limit. The supplier shall not correct or alter any dimension / details, without specific approval of BHEL.
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TECHNICAL CONDITIONS OF CONTRACT (TCC)

ANNEXURES:

Annexure-A: BOQ cum Rate Schedule for the Work of “Design, Supply and Expert Supervision for installation works of Borosilicate Glass Block Lining for 275 mtr tall single flue chimney at 1X660 MW Panki Thermal Power Plant at Panki, Kanpur, U.P.”.

Annexure-B: “SPECIFICATION NO **PE-TS-426-620-C002**, Section D, Sub-section D26” (TECHNICAL SPECIFICATION FOR BOROSILICATE GLASS BLOCK LINING SYSTEM) AND Document no. **PE-DC-426-100-N318** (CHIMNEY SIZING CALCULATION).

BOQ (ANNEXURE - A)

1X660 MW TPS Extension, Panki Thermal Power Station, Panki, Kanpur, Uttar Pradesh-208020.

BOQ FOR SUPPLY OF BOROSILICATE GLASS BLOCK LINING SYSTEM ON INNER SURFACE OF CORTEN-B STEEL FLUE CAN OF 275 M TALL SINGLE FLUE RCC CHIMNEY

					APPLICABLE FOR INDIGENOUS BIDDERS (DELIVERY TERMS : F.O.R. 1X660 MW TPS Panki) (BIDDER TO QUOTE IN INR)							APPLICABLE FOR FOREIGN BIDDERS (DELIVERY TERMS : CIF MUMBAI) (BIDDERS TO QUOTE IN USD)	
SL. No.	ITEM DESCRIPTION	HSN CODE	UOM	QUANTITY	UNIT RATE EX- WORKS (INR)	TOTAL EX- WORKS PRICE (INR)	FREIGHT & INSURANCE CHARGES (INR)	TOTAL EX- WORKS PRICE + FREIGHT & INSURANCE CHARGES (INR)	APPLICABLE GST RATE @... % ON (TOTAL EX WORKS PRICE + FREIGHT & INSURANCE CHARGES (INR))	TOTAL GST AMOUNT (INR)	TOTAL AMOUNT F.O.R. PANKI SITE (INR)	UNIT RATE ON CIF MUMBAI BASIS (USD) INCLUDING SEA WORTHY PACKING	TOTAL AMOUNT ON CIF MUMBAI (USD) INCLUDING SEA WORTHY PACKING
A	B	C	D	E	F	G=EXF	H	I = G+H	J	K=I X (J/100)	L=I+K	F'	G'=EXF'
1	LUMP SUM RATE FOR : (i) Supplying of closed cell borosilicate glass block of 51 mm thickness, conforming to physical and chemical properties mentioned in specification, offering chemical resistance to most acid, solvents & weak bases, should have proven resistance to thermal shock and also withstand occassinal excursion of the flue gas temperature etc all complete as per specification drawing and as directed by Engineer Incharge. (ii) Supply of Adhesives/membrance (thickness shall be minimum 3 mm behind & between each block) required for application as per specifications over surface area of 5715 square meters. (iii) Supply of suitable Epoxy primer required for application as per specifications over surface area of 5715 square meters. (iv) Supply of Mixing Machine , Special tools/tackles and T&P required for handling, storage, installation and test/ maintenance of borosilicate lining system Quantity (area) for payment shall be calculated by multiplying the height of MS flue over which blocks are installed with inner perimeter of flue over that height.		SQM	5715									
2	Providing expert supervision during surface preparation of substrate, application of primer, mixing of two components adhesives membrance by automated mixing machines, application of adhesive membrane and installation of borosilicate etc. all complete.		MAN-DAYS	80									
	TOTAL AMOUNT (i.e, 1 + 2)												

NOTES:

1	Taxes & Duties as per Cl. No. 14. of NIT
2	Supply of Borosilicate Glass Block Lining system consisting of 51 mm thick closed cell glass block lining material confirming to physical & chemical properties mentioned in technical specifications, handling, storage & transportation up to CIF Mumbai (for foreign bidders) /FOR Site (for Indigenous bidder) including required epoxy primer and adhesive membranes, Mixing Machine, Special tools/tackles and any other T&P etc. for application of borosilicate glass block lining over mild steel flue liners with adequate packing should be completed in all respects within the specified time schedule . It is bidder's responsibility to assess and supply all the material required for completion of specified scope taking into account wastages/normal loss/spoilages etc. unless otherwise stated.

BOQ (ANNEXURE - A)**1X660 MW TPS Extension, Panki Thermal Power Station, Panki, Kanpur, Uttar Pradesh-208020.****BOQ FOR SUPPLY OF BOROSILICATE GLASS BLOCK LINING SYSTEM ON INNER SURFACE OF CORTEN-B STEEL FLUE CAN OF 275 M TALL SINGLE FLUE RCC CHIMNEY**

3	The 5715 square meter area indicated for application of borosilicate glass block is tentative and may vary in case of change in design/application requirements. In case of any increase/decrease in the area in square meters the same shall be intimated before supply of borosilicate glass block, adhesives, membranes and primer etc. and the Lump Sum Price quoted shall be adjusted in proportion to the decrease/increase in the surface area. However, the prorata rate worked out for per square meter surface area shall be firm. The Adjustment in Lump Sum price of BOQ item no. 1 shall be made after deducting the price of Mixing Machine and Special T&P /Tools/Tackles (If any). The price of Mixing Machine and Special T&P /Tools/Tackles shall be considered as 1% of the total cost of BOQ item no. 1 for payment purpose.
4	The bidder shall provide details of total quantities of borosilicate glass block, adhesives, membranes and primer required for installation of borosilicate glass block lining over the indicated surface area of the chimney (as per details furnished in tender specifications/subsequent variations, if any) according to their detailed engineering. The Bidder shall submit the Billing Break-up (BBU) indicating the total quantities and Unit of Measurement for the indicated surface area for approval of BHEL. The Bidder shall also intimate the per square meter quantities of borosilicate glass, adhesives, membranes and primer required for application as per specifications.
5	The payment for supplies as per approved Billing Break-up shall be released on pro rata basis for the actual quantities of borosilicate glass, adhesives, membranes and primer supplied by the bidder limited to the lump sum price for the specified surface area after considering any subsequent changes. All the required quantities of the BOQ item indicated at Sl no. 1 for completion of installation of borosilicate glass lining for the surface area as per specifications/revised specifications shall form part of the lump sum quoted price and no extra financial implication for any increase/decrease in BBU quantities shall be admissible for payment.
6	In case of any increase/decrease in the quantities for the specified area, the bidder shall be responsible for its supply without any price implication within the indicated supply schedule.
7	The Manufacturer/supplier shall also provide ten (10) year of full replacement guarantee for the system, and bear the cost of replacement, supply, installation all complete, if the lining system deteriorates or fails to protect the chimney flue liner.
8	Supply of special T&Ps (as mentioned in clause 2.6.7) exclusively required for installation of Borosilicate Glass Block lining system shall also be in the scope of vendor .
9	Nominal adhesive/ membrane thickness shall be minimum 3 mm behind & between each block. A 1.5 mm thick layer should be troweled onto the MS liner as well as to the sides and back of each block before installation.



TITLE:

**BOROSILICATE GLASS BLOCK
LINING SYSTEM
(1X660 MW PANKI TPS EXT CHIMNEY)**

SPECIFICATION NO. PE-TS-426-620-C002

VOLUME - IIB

SECTION - D

SUB SECTION- D26

REV. 2

DATE 13/05/2019

SHEET 1 of 9

VOLUME: II B

SECTION – D

SUB SECTION – D26

BOROSILICATE GLASS BLOCK LINING SYSTEM

SPECIFICATION NO. PE-TS-426-620-C002



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:

**BOROSILICATE GLASS BLOCK
LINING SYSTEM**
(1X660 MW PANKI TPS EXT CHIMNEY)

SPECIFICATION NO. PE-TS-426-620-C002

VOLUME - IIB

SECTION - D

SUB SECTION- D26

REV. 2

DATE 13/05/2019

SHEET 2 of 9

Table of Contents

1. Project Description
 - 1.1 Description
 - 1.2 Flue gas characteristics
 - 1.3 General configuration
2. Scope of work
 - 2.1 scope of supply
 - 2.2 Bidder services
3. Special equipment, Tools and Instruments
4. Standard and codes
5. Quality assurance and quality control
6. Safety, Noise and Environment requirements
 - 6.1 Safety
 - 6.2 Environment data
7. Mechanical Technical Requirement
 - 7.1 Design parameters
 - 7.2 Operating conditions
 - 7.3 Performance Requirements
 - 7.4 Design requirements
 - 7.5 Material requirements
8. Handling, Storage and protection
 - 8.1 Facilities
 - 8.2 Storage
9. Job site inspection and preparation

 Maharatna Company	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (1X660 MW PANKI TPS EXT CHIMNEY)	SPECIFICATION NO. PE-TS-426-620-C002	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 2	DATE 13/05/2019
		SHEET 3 of 9	

1 PROJECT DESCRIPTION

1.1. Description

The subject project includes one tall R.C.C chimney of 275m high with single corten-B steel flue and borosilicate glass block lining system on inside surface of flue.

1.2. Flue gas characteristics (Refer Annexure I)

The chimney shall be working with FGD in line mode as well as bypass mode with the operating conditions for the flue gases shall be as per Annexure-I.

1.3. General configuration

The Chimney general arrangement configuration shall be as provided elsewhere in the specification. However, during detailed engineering, minor modification may be done. with owner’s consent, without any extra cost implication.

2 SCOPE OF WORK

2.1 The scope of work includes Engineering, materials, equipment’s and Services for the:

2.1.1 Design, preparation of drawing, material supply, fabrication, erection, application, Handling, transportation, storage, preserve, pack and furnish with adequate moisture proof packing, test and on site, application of borosilicate glass block lining system, over corten-B steel liner in the chimney, including:

a) Supply of suitable primer, supply of two components adhesive membrane and supply of closed cell borosilicate glass blocks.

b) Required Surface finish (minimum (SA 2 1/2)) of internal surface of corten-B flue can, on ground or in erected position, over which borosilicate lining system can be applied, using grit blasting, and application of suitable epoxy primer, under expert supervision by borosilicate glass block lining manufacturer/supplier.

c) Installing closed cell borosilicate glass block lining system, over all heights, on ground or in erected position, on internal surface of corten-B steel flue can & SS mini shell, using two component suitable adhesive membrane material under controlled temperature and humidity conditions, including cost of skilled labor, material, tools & tackles, equipment required to create controlled temperature & humidity conditions on ground or in erected flue can during installation, hot blow cleaning (after priming) of internal surface before application, mixing of two components adhesive membrane by automated mixing machines etc. all complete.

d) Complete onsite QA and supervision, by borosilicate glass block lining manufacturer/supplier, during surface finish, application of primer, application of two components adhesive membrane, installation of borosilicate glass block on internal surface of flue can.

e) Ten (10) year full replacement guarantee, including cost of supply, erection, enabling works, all labor, material, adhesive, primer, surface preparation, arrangement for

 Maharatna Company	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (1X660 MW PANKI TPS EXT CHIMNEY)	SPECIFICATION NO. PE-TS-426-620-C002	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 2	DATE 13/05/2019
		SHEET 4 of 9	
application etc. all complete, and fulltime onsite QA supervision during erection & commissioning. During the guarantee period if the lining system fails to protect the chimney flue from deterioration, the borosilicate glass block lining manufacturer/supplier shall replace the partially affected portion or complete borosilicate lining system without any additional cost, including all labor, material, surface finish (SA 2 1/2), supply and application of primer, supply and application of two component adhesive membrane, supply and application of closed cell borosilicate glass blocks, arrangement for application on erected flue cans etc all complete with onsite QA supervision of borosilicate glass block supplier. Corten-B steel flue can fabrication and erection is not in this scope of work and shall be done by chimney EPC contractor. 2.1.2 All necessary parts, and works necessary for transport, storage and application purposes. Coordination with chimney designer & chimney contractor- providing required inputs. 2.1.3 Submission of the drawings and getting the same approved from BHEL and the project owner for borosilicate glass block lining system, erection, transportation and storage. 2.1.4 The Bidder shall furnish all design, labor, materials, tools and equipment necessary for the installation of borosilicate lining system, as indicated and specified herein. 2.1.5 The Work shall include everything requisite and necessary to finish the job properly, to the satisfaction of engineer in charge, notwithstanding that every item of labor or materials or accessories required to make the installation complete may not be specifically mentioned. 2.1.6 The Equipment / material for the Unit shall be supplied complete with provisions for appurtenances and accessories, to form a complete system which will achieve and assure safe and reliable operation with best overall performance. 2.1.7 Bidder shall provide, in the required format and form and in a timely manner, all drawings and documentation required by this Specification and/or required by applicable Standards and codes. A consistent nomenclature shall be used project-wide in naming all component parts within the Scope of Work. This shall apply to all drawings, Bill of Materials, special instructions, etc. The cost of correcting inconsistent nomenclature shall be borne by the Bidder. 2.1.8 Changes in design and drawings already approved by the owner are normally unaccepted. However, should such changes become necessary on an exceptional basis, the Bidder shall obtain the owners approval prior to introducing any such change. 2.2 Bidder Services Field personnel provided by the Bidder shall be capable and qualified to perform the required duties to the satisfaction of BHEL and the owner. Erection services: The Bidder shall furnish competent supervision for erecting the equipment provided under this Specification. The erection services shall be coordinated with other agencies in the scope of the subject chimney contract.			

	TITLE:	SPECIFICATION NO. PE-TS-426-620-C002	
	BOROSILICATE GLASS BLOCK LINING SYSTEM (1X660 MW PANKI TPS EXT CHIMNEY)	VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 2	DATE 13/05/2019
		SHEET 5 of 9	

3

SPECIAL EQUIPMENT, TOOLS AND INSTRUMENTS

Bidder shall provide all special equipment, tools and instruments, skilled manpower required for handling and storage, and for test and maintenance of borosilicate lining system provided under this Contract.

4

STANDARDS AND CODES

4.1

The borosilicate lining system to be provided under this Specification, including all appurtenances and accessories, shall be designed, fabricated, inspected, tested, stamped and preserved to the extent indicated in said referenced Standards and Codes. Where this Specification does not include such reference, the system, or any of its components, shall be designed, fabricated, inspected, tested and preserved, as applicable, to comply with currently recognized International and/or manufacturer’s specification, whichever is stringent and more restrictive.

4.2

In all cases Bidder shall adhere to and comply with the requirements of Indian standards, which are found to be more restrictive than those specified herein.

5

QUALITY ASSURANCE AND QUALITY CONTROL

5.1

The Bidder shall submit upon request a copy of Its Quality Assurance Manual including Quality Procedures.

5.2

The Bidder shall conduct an inspection and testing program which shall record and verify the essential properties of the constituent materials and the finished liner.

5.3

The Bidder shall conduct test to verify the mechanical properties of borosilicate bricks and adhesive/mortar and the tests shall be documented during the course of design and fabrication, and shall be made available to owner.

5.4

Unless otherwise specified the bidder’s standard tests shall be performed on all batches of materials furnished. The owner may or may not elect to witness tests, but the bidder shall notify the Owner’s Quality Assurance Department no later than 10 days in advance of all scheduled tests.

6

SAFETY, NOISE AND ENVIRONMENT REQUIREMENTS

6.1

SAFETY

The equipment supplied under this Specification shall meet the U.S. "OCCUPATION, SAFETY, AND HAZARD ADMINISTRATION" (OSHA) requirements or equivalent.

6.1.1

Jobsite Safety and Scrap Disposal

o

Safety programs and procedures shall be within the scope of this Specification, it should be noted that the all materials that are potentially flammable materials and must be handled in keeping with



TITLE:

**BOROSILICATE GLASS BLOCK
LINING SYSTEM
(1X660 MW PANKI TPS EXT CHIMNEY)**

SPECIFICATION NO. PE-TS-426-620-C002

VOLUME - IIB

SECTION - D

SUB SECTION- D26

REV. 2

DATE 13/05/2019

SHEET 6 of 9

good industry practice and in compliance with the manufacturer's recommendations.

- Owner shall supply the Bidder with the applicable rules and regulations for disposal of scrap and waste materials, which are to be followed by the bidder.

6.1.2 Safety and protection of work and property:

The Bidder shall provide for the safety and protection of the work and of materials and equipment to be incorporated therein, whether in storage on or off the site. Provide protection at all times against rain, wind, storms, condensation, or heat so as to maintain all work and equipment and materials free from injury of damage. At the end of each day, all new work likely to be damaged shall be appropriately protected.

6.2 Environmental Data

6.2.1 Should the lining system to be furnished by the Bidder have discharge points to the environment and/or generate waste materials that must be discharged to the environment, the Bidder shall provide, upon Purchaser's request, a plan for the treatment of the discharge/waste to meet current regulations of the Indian government/ regulatory authorities.

6.2.2 The Bidder shall submit, within thirty (30) days of demand, additional information on noise and/or other environmental data. All information shall be prepared in a manner acceptable Indian government/ regulatory authorities.

7 TECHNICAL REQUIREMENTS

7.1 Design parameters

7.1.1 Liner considerations

The borosilicate glass block liner will have a minimum thickness of 51 mm for all its entire length. Proper provisioning should be made for borosilicate lining system for lining around gas sampling ports, expansion joints, man holes and other appurtenances.

7.2 Operating conditions

- Operating conditions shall be as per Annexure-I
- A margin of 15 deg centigrade above the operating conditions mentioned in Annexure-I shall be taken while selecting the appropriate material and thickness for design of the lining system.



TITLE:

**BOROSILICATE GLASS BLOCK
LINING SYSTEM
(1X660 MW PANKI TPS EXT CHIMNEY)**

SPECIFICATION NO. PE-TS-426-620-C002

VOLUME - IIB

SECTION - D

SUB SECTION- D26

REV. 2

DATE 13/05/2019

SHEET 7 of 9

7.3 Performance Requirements

- 7.3.1 Borosilicate brick lining system will be designed in such a way that it will not require unscheduled outages for repair except for planned and scheduled routine maintenance and inspections.
- 7.3.2 Borosilicate brick lining system and all of the required components will be designed for a safe, useful life of thirty (30) years (minimum).
- 7.3.3 Ten (10) year full replacement guarantee, including cost of supply, erection, enabling works, all labor, material, adhesive, primer, surface preparation, arrangement for application etc. all complete, and fulltime onsite QA supervision during erection & commissioning. During the guarantee period if the lining system fails to protect the chimney flue from deterioration, the borosilicate glass block lining manufacturer/supplier shall replace the partially affected portion or complete borosilicate lining system without any additional cost, including all labor, material, surface finish (SA 2 $1/2$), supply and application of primer, supply and application of two component adhesive membrane, supply and application of closed cell borosilicate glass blocks, arrangement for application on ground or erected flue cans etc all complete with onsite QA supervision of borosilicate glass block supplier.
- 7.3.4 The lining system (borosilicate glass block and adhesive) shall be offered by a supplier with demonstrated capabilities in the area of onsite technical support and QA/QC supervision, who employs QA/QC supervisors with a demonstrated experience in technical support and QA/QC supervision of the subject lining system.
- 7.3.5 The supplied lining system (borosilicate glass block and adhesive) shall be capable of withstanding fire risk for a minimum period of 2 hours as per ASTM E-119. Proper certification from an independent institute of sufficient knowledge and experience shall be submitted by supplier subject to acceptance by the project owner, showing the capability of the lining system (borosilicate glass block and adhesive) to protect the steel chimney flues from structural damage by fire of said rating.
- 7.3.6 Supplier shall produce certificates from an independent institute of sufficient knowledge and experience, subject to acceptance by the project owner, showing that the workers can do the work on supplied lining system safely, without any adverse health effects and without requiring excessive protective measures.

7.4 Design Requirements



TITLE:

**BOROSILICATE GLASS BLOCK
LINING SYSTEM
(1X660 MW PANKI TPS EXT CHIMNEY)**

SPECIFICATION NO. PE-TS-426-620-C002

VOLUME - IIB

SECTION - D

SUB SECTION- D26

REV. 2

DATE 13/05/2019

SHEET 8 of 9

7.4.1 General

- Design of the borosilicate lining system must be performed by a professional engineer in the design of such system for chimney flues.
- Specified requirements of this specification are to be regarded as minimum requirements. If the Fabricator's design and/or experience dictate these minimum requirements should be exceeded, the design, supply and application shall be performed accordingly, without any extra cost implication.

7.5 Materials Requirements

The steel chimney flues, made of minimum 10 mm thick corten-B steel, shall be internally protected with a lining system consisting of 51 mm thk closed cell borosilicate glass blocks, applied with a flexible, chemically resistant adhesive, using a lining system that meets all of the following requirements:

7.5.1 The lining system shall use closed cell borosilicate glass blocks with the following Physical properties:

- a. Minimum Density of $0.144 \times 10^3 \text{ kg/m}^3$
- b. coefficient of linear thermal expansion not greater than $5.5 \times 10^{-6} / ^\circ\text{C}$,
- c. Minimum compressive strength of 1.00 Mpa as per ASTM C 165,
- d. Minimum flexural strength of 0.62 Mpa as per ASTM C.203/C.240.
- e. The blocks shall be resistant to thermal cyclic loading under FGD bypass/ hot gas service conditions, and sudden temperature changes, including high temperature spikes.

7.5.2 The borosilicate glass block system shall use a flexible, chemically resistant adhesive, with all required surface preparation, primer, labor, equipment etc., all complete. The adhesive membrane shall be a 2-component having excellent elastomeric properties and be acid & heat resistant. The adhesive membrane shall be applied in between and behind the blocks in a 3 mm thick layer ensuring a proper bond and adhesion. The adhesive membrane shall have the following properties.

- a. Minimum tensile strength at 23°C greater than or equal to 1.0 N/mm² as per ASTM D.412
- b. Resistant to corrosive flue gas environments.
- c. Remain elastomeric and flexible under hot gas conditions and sudden temperature changes.
- d. The adhesive shall be suitable for trowel application.



TITLE:

**BOROSILICATE GLASS BLOCK
LINING SYSTEM
(1X660 MW PANKI TPS EXT CHIMNEY)**

SPECIFICATION NO. PE-TS-426-620-C002

VOLUME - IIB

SECTION - D

SUB SECTION- D26

REV. 2

DATE 13/05/2019

SHEET 9 of 9

7.5.3 The steel surface shall be grit blasted to a cleanliness of SA 2 1/2 and approved by the supplier of the lining system. The substrate shall thereafter be primed using a high performance epoxy primer within a short time window approved by the supplier. The lining system manufacturer shall demonstrate a proven Quality Control system that monitors and documents the key physical properties, as described above.

8 HANDLING, STORAGE AND PROTECTION

8.1 Facilities

- 8.1.1 Bidder shall construct adequate facilities for the storage of material. Upon completion of fabrication, the Bidder shall remove the fabrication facility from the site and return the area to the pre-construction condition.
- 8.1.2 The installation of borosilicate lining system must be done in a suitable environment (temperature, humidity etc. control as per manufacturer recommendation to stand by the required guarantee). Maintenance of the required suitable condition and any tools/tackles, machinery required to maintain the controlled environment during installation of borosilicate glass block shall be in the scope of bidder.

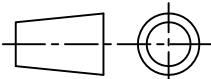
8.2 Storage

- 8.2.1 Materials shall be stored in a dry area and within the temperature and humidity limits recommended by the material Bidders. Do not allow shelf-life limits, as determined by the Bidder, to be exceeded.
- 8.2.2 Materials surfaces shall be protected from dust, fog, rain and other contaminants.
- 8.2.3 Affected plies shall be removed if any of the above requirements are not met during final surface preparation. The surface exposed due to the removal of the plies shall be abraded and prepared, per this Specification, before applying new plies.

9 JOB SITE INSPECTION AND PREPARATION

9.1 In coordination with the chimney contractor the borosilicate installation agency should submit a plan detailing the application sequence and methods to be employed, including moving, handling, storage, erection, fit up and the methods to be used for environmental protection.

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REV. 01	DATE 21.11.18	ALTERED: AKS/MS CHECKED: SSV	REV. 02	DATE 5.12.18	ALTERED: AKS/MS CHECKED: SSV			
REVISED INLINE WITH CUST. COMMENTS DATED 15/11/18.			REVISED INLINE WITH CUST. COMMENTS DATED 29/11/18.					
						JOB NO. 426		
REV. 03	DATE 27.12.18	ALTERED: AKS/MS CHECKED: SSV	ANNEXURE-I					
REVISED INLINE WITH CUST. COMMENTS DATED 26.12.18								
NTPC DOC NO.		9962-001-PE-102-PVM-U-601				R3		
PROJECT		1 X 660 MW PANKI UPRVUNL PANKI TPS EXT. (EPC)						
CUSTOMER		UTTAR PRADESH RAJYA VIDYUT UTPADAN NIGAM LTD.						
REVIEW CONSULTANT		NTPC LTD						
CONSULTANT		DEVELOPMENT CONSULTANT PVT LTD, KOLKATA						
REF.DRG. NO.		 BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING MANAGEMENT, NOIDA						
DEPT. M	CODE 20		SCALE NTS	WEIGHT(KG) -	REF TO ASSY DRG. -	ITEM -		
CHIMNEY SIZING CALCULATION					PREP.	NAME AKS/MS	SIGN -sd-	DATE 26.10.18
					CHECKED	RKV	-sd-	26.10.18
					APPD.	CM	-sd-	26.10.18
CHICDOVER	DEPT.					CARD CODE -	DRAWING NOS.	
	SIGN		N.A.				PE-DC-426-100-N318	
	DATE						NO. OF SHEETS 2 INCLUDING COVER	
						R03		

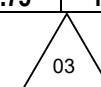
बीएचईएल	TITLE:	DOCUMENT NO.:	PE-DC-426-100-N318
		REVISION NO.:	03
	CHIMNEY SIZING CALCULATION	DATE:	27.12.2018
		1 X 660 MW PANKI	SHEET:

1X 660 MW PANKI UPRVUNL PANKI TPS EXTENSION (EPC)

(As per specification clause no. 12.5.2: Design of steel liners, Volume-VI: Civil, structural & architectural works, chapter 12 RCC chimney, sheet 8 of 22)



Parameter	Units	TMCR-WC	BMCR-DC	BMCR-WC	BMCR-BC	TMCR-DC	60% TMCR-DC	60% TMCR-WC
Flue gas quantity at GGH outlet.	T/Hr	2867.5	3195.9	3314.7	3174.3	2717.4	1763	1787.6
Temp. of flue gas at stack inlet	°C	101	98.3	103.9	97.1	96.7	92.2	93.1
Flue gas density at stack inlet	Kg/m ³	0.941	0.959	0.933	0.956	0.965	0.949	0.963
Volumetric flow of flue gas	M ³ /s	846.47	925.70	986.87	922.33	782.21	516.04	515.63
Stack Height	M	275	275	275	275	275	275	275
Ambient air temp.	°C	27	27	27	27	27	27	27
Relative Humidity	%	60	60	60	60	60	60	60
Internal flue dia	M	6.618	6.618	6.618	6.618	6.618	6.618	6.618
Flue gas velocity at stack exit	m/sec	24.62	26.92	28.70	26.83	22.75	15.01	15.00



Note: The COR-TEN B flue liner ID shall be 6.7 M. considering 38 mm Boroscillate liner and 3 mm glue. Net effective flue ID shall be 6.618 M



**Flue Gas Parameters at GGH outlet****DATA FOR CHIMNEY DESIGN**

GENERAL DATA								
Boiler Application		Utility	No.of Chimneys		One			
Boiler Capacity			Type of Chimney		BY PEM			
No. of Boilers		One(1)	Chimney Arrangement		BY PEM			
Fuels Fired		Coal	Height of Chimney		BY PEM			
OPERATING CONDITIONS								
DESCRIPTION / LOAD		TMCR WC	BMCR DC	BMCR WC	BMCR BC	TMCR DC	60% TMCR DC	60% TMCR WC
Flue Gas Flow	t / h	2867.5	3195.9	3314.7	3174.3	2717.4	1763.0	1787.6
Flue Gas Volume	m ³ / s	846.2	926	987.1	922.8	782	501.4	515.8
Flue Gas Temperature	°C	101	98.3	103.9	97.1	96.7	92.2	93.1
Flue Gas Density	kg / m ³	0.941	0.959	0.933	0.956	0.965	0.977	0.963
FGD OUTLET-FLUE GAS COMPOSITION % BY WEIGHT – (WET BASIS)								
CO ₂		18.15	18.71	17.57	17.83	19.89	19.19	18.05
N ₂		68.29	68.64	68.38	68.95	68.36	68.65	68.47
O ₂		5.78	6.31	6.29	6.32	5.30	5.93	5.92
SO ₂		0.0061	0.0060	0.0059	0.0059	0.0064	0.0061	0.006
H ₂ O		7.77	6.34	7.76	6.88	6.44	6.20	7.54
*DUST SIZE DISTRIBUTION AT CHIMNEY INLET – (% MICRONS)								
Below 3	Same as ESP Outlet		Between 10 - 20		Same as ESP Outlet			
Between 3 - 5	Same as ESP Outlet		Between 20 - 30		Same as ESP Outlet			
Between 5 - 10	Same as ESP Outlet		Between 30 - 40		Same as ESP Outlet			
OTHER DATA								
Elevation of Breeching Line of the Duct					m			
Chimney Opening Dimensions					m x m			
Flue Gas Pressure at Chimney Entry Level					mmwc			
REMARKS : *APPLICABLE ONLY FOR COAL FIRING								
a) Suitable Margins may be added over and above the given operating conditions for chimney design.								
b) The elevation of breeching line of duct and the chimney opening size shall be designed by Chimney designer in consultation with Trichy.								
c) Above FGD Outlet Flue gas volume is for one boiler.It shall be considered half if there exists Two (2) flues in a chimney for chimney flue design.								
d) FGD can be bypassed at times by customer, so Chimney sizing data of Trichy shall hold good when FGD is bypassed.								
Customer / Plant: UPRVUNL PANKI- 1x660 MW								
Prop .No.:	Rev. 0		Rev. 1		Rev. 2		Rev. 3	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer	KABILASH	06.07.18		27.11.18		04.12.18		
Reviewer	SASHI	06.07.18		27.11.18		04.12.18		
Approver	SK DASH	06.07.18		27.11.18		04.12.18		

PROJECT: PANKI 1X660 MW									
DATA FOR CHIMNEY DESIGN								REV:00	04.12.2018
S.NO	PARAMETER	UNIT	TMCR-WC	BMCR-DC	BMCR-WC	BMCR-BC	TMCR-DC	60% TMCR WC	60% TMCR DC
A - UNTREATED FLUE GAS AT GGH INLET									
1	Flue gas quantity	TPH	2814.48	3135.80	3249.24	3116.91	2668.42	1755.38	1730.47
2	Temp. of Flue gas at stack inlet	° C	135	133	140	130	130	122	123
3	Flue gas Density at stack inlet	Kg/m ³	0.87217	0.88666	0.86107	0.88694	0.89505	0.90075	0.9098
4	Volumetric flow of Flue gas	m ³ /s	896.39	982.4	1048.18	976.18	828.14	541.33	528.34
SI.NO	PARAMETER	UNIT	TMCR-WC	BMCR-DC	BMCR-WC	BMCR-BC	TMCR-DC	60% TMCR WC	60% TMCR DC
B - UNTREATED FLUE GAS AT GGH OUTLET									
1	Flue gas quantity	TPH	2815.02	3136.41	3249.9	3117.48	2668.92	1755.71	1730.8
2	Temp. of Flue gas at stack inlet	° C	82.8	79.6	84.6	79.4	78.7	77.5	75.6
3	Flue gas Density at stack inlet	Kg/m ³	1.00	1.02073	0.99424	1.01408	1.02544	1.01503	1.03336
4	Volumetric flow of Flue gas	m ³ /s	781.89	853.53	907.97	853.95	722.97	480.48	465.26
SI.NO	PARAMETER	UNIT	TMCR-WC	BMCR-DC	BMCR-WC	BMCR-BC	TMCR-DC	60% TMCR WC	60% TMCR DC
C - TREATED FLUE GAS AT GGH INLET									
1	Flue gas quantity	TPH	2867.93	3196.4	3315.26	3174.85	2717.86	1787.89	1763.61
2	Temp. of Flue gas at stack inlet	° C	50.9	47	50.8	48.5	47.4	50.3	46.7
3	Flue gas Density at stack inlet	Kg/m ³	1.08679	1.11199	1.08536	1.09971	1.11368	1.08993	1.11569
4	Volumetric flow of Flue gas	m ³ /s	733.03	798.47	848.48	801.94	677.89	455.66	439.02