NHPC LIMITED
(A Govt. of India Navratna Enterprise)
NHPC Office Complex, Sector-33, Faridabad-121003, Haryana (India)
CIN: L40101HR1975GOI032564

Dated: 23.07.2025

Corrigendum No.2 along with Informative Replies

Name of Work: Lot-III: Electro-mechanical works package of 240 MW (2X120MW) Uri-I Stage-II H.E Project, Baramulla District of UT of J&K, India.

Ref: Tender Specification No. NH/Conts(E&M)-III/Uri-I Stage-II/ENM/ 2025/01

[E-Tender ID: 2025_NHPC_861342_1]

In reference to subject tender, pursuant to queries received from Prospective Bidders before & after Pre-Bid meeting held on 20.06.2025, **Techno-commercial Amendments** are annexed as 'Commercial_Amendment_01, 'Technical_D_Amndment_01' and 'Technical_Q_Amendment_01'.

All other terms & conditions and specifications of the Bid Document shall remain unchanged.

For & on behalf of NHPC Ltd.,

Sd/-

General Manager,
Contracts (E&M)-III,
2nd Floor, Jyoti Sadan, NHPC Office Complex,
Sector-33, Faridabad-121003 (Haryana),
Tele # 0129-2254687
E-mail: nalinikantverma@nhpc.nic.in

Description of Work: Lot-III: Electro-mechanical works package of 240 MW (2X120MW) Uri-I Stage-II H.E Project, Baramulla District of UT of J&K, India

Tender Specification No.:- NH/NH/Conts(E&M)-III/Uri-I Stage-II/ENM/2025/01

Tender ID.: 2025_ NHPC_861342_1

Commercial_Amendment_01

Sl. No.	Description of referred clause	Referred Clause No.	Existing Clause of Tender Document	Modified provision of Tender Document
	Volume-0-NIT / ITB			
1.	**BRIEF DETAILS OF TENDER**	**NIT Clause No.1.1 (v): Estimated Cost**	INR 485.40 Crore	**INR 480.59 Crore (inclusive of GST)**
2.	**GENERAL EXPERIENCE**	**NIT / ITB Cl. NO.2.2.1 : 2nd Para**	1. One Electro Mechanical work costing not less than INR **388.32** Crore , **Or** 2. Two Electro Mechanical works each costing not less than INR **242.70** Crore, **Or** 3. Three Electro Mechanical works each costing not less than INR **194.16** Crore.	2nd Para is deleted and replaced as under: 1. One Electro Mechanical work costing not less than INR **384.47** Crore , **Or** 2. Two Electro Mechanical works each costing not less than INR **240.30** Crore, **Or** 3. Three Electro Mechanical works each costing not less than INR **192.24** Crore.
3.	**GENERAL EXPERIENCE**	**NIT / ITB Cl. No.2.2.3 (i): Turnover**	The bidder should have Minimum average annual turnover of **INR 192 Crores** for the immediately preceding two (02) consecutive financial years.	The bidder should have Minimum average annual turnover of **INR 161 Crores** for the immediately preceding two (02) consecutive financial years.
4.	**NIT/ ITB Cl. No. 2.2.1: General Experience & Cl. No. 2.2.2: Specific Experience**	**Note: (iii) under NIT /ITB Cl. No. 2.2.1 & 2.2.2**	Note: (iii) : Substantial Completion is when the works are completed in a condition that it is capable of being occupied and used by Employer for the purpose for which it is intended. Substantial completion shall be based on 80 (eighty) per cent (value wise) or more works completed under the contract.	Substantial Completion is when the works are completed in a condition that it is capable of being occupied and used by Employer for the purpose for which it is intended. Substantial completion shall be based on 80 (eighty) per cent (value wise) or more

Sl. No.	Description of referred clause	Referred Clause No.	Existing Clause of Tender Document	Modified provision of Tender Document
			Substantial completion should not be defined in terms of percentage completion, rather it should be based on functional consideration. For contracts under which the bidder participated as a joint venture member or sub-contractor, only the bidder's share, by value, shall be considered to meet this requirement. Certificate for 'substantial completion' of project/work/asset should contain two parts. Part -I shall contain 'financial value of work done' and part-II shall contain 'certificate of functional completion of project/work/asset'.	works completed under the contract. ~~Substantial completion should not be defined in terms of percentage completion, rather it should be based on functional consideration.~~ For contracts under which the bidder participated as a joint venture member or sub-contractor, only the bidder's share, by value, shall be considered to meet this requirement. ~~Certificate for 'substantial completion' of project/work/asset should contain two parts. Part -I shall contain 'financial value of work done' and part-II shall contain 'certificate of functional completion of project/work/asset'.~~
5.	**BID CAPACITY**	**NIT/ITB Cl. No.2.2.4 : 1st Para**	The available Bid capacity of the Bidder at the time of submission of Price bid, calculated as under should not be less than INR **485.40** Crores.	The available Bid capacity of the Bidder at the time of submission of Price bid, calculated as under should not be less than INR **480.59** Crores.
6.		**ITB Cl. No. 2.2.7: Header of the referred clause**	APPLICATIONS/ BIDS BY MERGED / ACQUIRED / SUBSIDIARY COMPANIES	The said header is modified and replaced as under : **BIDS BY MERGED / ACQUIRED / SUBSIDIARY COMPANIES**
7.	**GENERAL EXPERIENCE RECORD**	**ITB: ELIGIBILITY FORM-2: 2nd para under 1. General Experience**	1. One Electro Mechanical work costing not less than INR **388.32** Crore , **Or** 2. Two Electro Mechanical works each costing not less than INR **242.70** Crore, **Or** 3. Three Electro Mechanical works each costing not less than INR **194.16** Crore.	2nd Para is deleted and replaced as under: 1. One Electro Mechanical work costing not less than INR **384.47** Crore , **Or** 2. Two Electro Mechanical works each costing not less than INR **240.30** Crore, **Or**

Sl. No.	Description of referred clause	Referred Clause No.	Existing Clause of Tender Document	Modified provision of Tender Document
				3. Three Electro Mechanical works each costing not less than INR **192.24** Crore.
	Volume-I: IFB			
8.	**Other Enclosures**	**21**	Petrographic analysis report and Chemical Test Report as Annexure-II.	Petrographic analysis report and Chemical Test Report as Annexure-II **& Water Analysis report as Annexure-III**. (attached as **Attachment-1_ Commercial_Amendment_01 to this Corrigendum)**
	Volume-IIA: GCC			
9.	**Completion Time Guarantee**	**26.2 : Last Para**	Any GST liability on account of levy of Liquidated Damages shall be borne by the Contractor.	DELETED
10.	**Transfer of Ownership**	**25.1**	Ownership of the Plant and Equipment (including spare parts) to be imported into the country where the Site is located shall be transferred to the Employer upon loading on to the mode of transport to be used to convey the Plant and Equipment from the country of origin to that country and upon endorsement of the dispatch documents in favour of the Employer.	DELETED
11.	**Insurance**	**34.1: 1st Para**	To the extent specified in Appendix 3 (Insurance Requirements) to the Contract Agreement, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval.	1st Para of GCC Cl. No. 34.1 is deleted and replaced as under (modification shown in track change) : To the extent specified in Appendix 3 (Insurance Requirements) to the Contract Agreement, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix **for 34.1 (except b: Erection All Risk Insurance).**

Sl. No.	Description of referred clause	Referred Clause No.	Existing Clause of Tender Document	Modified provision of Tender Document
				Further, the Employer shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and other conditions specified in the said Appendix for 34.1(b: Erection All Risk Insurance) The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval.
12.	**Insurance**	**34.2**	The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1 except for the Cargo Insurance during Transport, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.	The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1 except for the Cargo Insurance during Transport, Workers' Compensation and Employer's Liability Insurances. **The Contractor shall be named as co-insured under Erection All Risk Policy taken by Employer pursuant to GCC Sub-Clause 34.1.** All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.
13.	**Valuation of Idling Time Cost Claims**	**Annex-A: Sl. No. 1 (a) i: 2nd Para of**	Depreciation cost = {(Idle period in days/365) × 0.67 × Annual Depreciation}.	Depreciation cost = {(Idle period in days/365) × **0.5** × Annual Depreciation **as per IS 11590:1995**}.

Sl. No.	Description of referred clause	Referred Clause No.	Existing Clause of Tender Document	Modified provision of Tender Document
		GCC Cl. No. 41.3		
14.	**Bank guarantee and Insurance Charges**	**Annex-A: Header of Sl. No. 3 :**	3.Bank Guarantee and Insurance Charges	3.Bank Guarantee **~~and Insurance~~** Charges
15.	**Panel of Experts (IE)**	**GCC Cl. No.6.1.1 - Annexure-B1**	Annexure B1	Annexure-B1 is deleted and replaced with "Annexure-B1" attached as **"Attachment-2_ Commercial_Amendment_01"** to this corrigendum.
	Volume- II B-SCC			
16.	**Financial Arrangement**	**12.1**	In the event that the Employer make financing arrangement for the work package by means of Buyers Credit from International Banks through the Export Credit Agencies of the Country concerned to the extent the goods and services covered in the package are imported from OECD countries, the Contractor shall, in case of award of Contract, facilitate completion of any such formalities as may be required by the respective export credit agency to enable NHPC to avail Buyers Credit for funding eligible goods and services covered in the package. The Contractor shall make similar compliance in respect of its sub-vendors/sub-contractors to the extent the goods are imported from concerned OECD country, if applicable.	DELETED
17.	**Penalty on account of non-attendance of fault in Control, Monitoring and SCADA System**	**22 :** The text "Cl. 15.1.8(iii)" and the text "Cl. 15.4.1"	-	The text "Cl. 15.1.8(iii)" is deleted and replaced with ""Cl. 14.1.9(iii)" and the text "Cl. 15.4.1" is deleted and replaced with "Cl. 14.4.1".

Sl. No.	Description of referred clause	Referred Clause No.	Existing Clause of Tender Document	Modified provision of Tender Document
18.	**Sustainability Standards based on Environment, Social and Governance (ESG) Parameters**	**26**	In order to comply with Policy on Business Responsibility and Sustainability Report (BRSR) of Employer available on web 'www.nhpcindia.com', the contractor as a Value Chain Partner shall submit disclosures with every Interim Payment bill and final bill during execution of contract in the format prescribed at Annexure-III certifying their compliances towards Sustainability Standards based on Environment, Social and Governance (ESG) Parameters. The contractor shall provide free and smooth access to the authorized person(s) of Employer in its premises (office/ assets/ locations/ units etc.) to confirm / evaluate / rectify the same, as and when required. In order to comply with Policy on Business Responsibility and Sustainability Report (BRSR) of Employer available on web shall submit disclosures with every RA bill and final bill during execution of contract in in the format prescribed at Annexure-III certifying their compliances towards Sustainability Standards based on Environment, Social and Governance (ESG) Parameters. The contractor shall provide free and smooth access to the authorized person(s) of Employer in its premises (office/ assets/ locations/units etc.) to confirm / evaluate / rectify the same, as and when required.	2nd Para is Deleted
19.	**Model Distribution of Shipping Documents**	**Annex-II: Header of Column 4**	Engineer-in-charge Dibang HE Project	The text "Engineer-in-charge Dibang HE Project" is hereby deleted and replaced with " Engineer-in-charge Uri-I Stage-II HE Project"
	Volume-V-Forms & Procedures			
20.	**Letter of Authorisation (for MIV)**	**Attachment-10 : Subject**	Invitation of Bids for Lot-6: Electro-Mechanical Works of Dibang Multipurpose Project (12X240 MW), Roing, Arunachal Pradesh, India	Invitation of Bids for Lot-III: Electro-mechanical works package of 240 MW (2X120MW) Uri-I Stage-II H.E Project, Baramulla District of UT of J&K, India
21.	**Letter of Authorisation (for MIV)**	**Attachment-10 : 2nd para**	We further undertake that we shall be directly responsible to the Employer for guarantees & warrantees for the item (s) of equipment manufactured by us and shall be jointly and severally responsible with M/s (Name of the Bidder) for the performance of the Contract(s) for which we will submit additional performance bank guarantee of value equivalent to 3% of the award value of the items of equipment mentioned	We further undertake that we shall be directly responsible to the Employer for guarantees & warrantees for the item (s) of equipment manufactured by us and shall be jointly and severally responsible with M/s (Name of the Bidder) for the performance of the Contract(s) for which we will submit additional performance bank

<table>
<tr><th>Sl. No.</th><th>Description of referred clause</th><th>Referred Clause No.</th><th>Existing Clause of Tender Document</th><th>Modified provision of Tender Document</th></tr>
<tr><td></td><td></td><td></td><td>above, if awarded.</td><td>guarantee of value equivalent to 5% of the award value of the items of equipment mentioned above, if awarded.</td></tr>
<tr><td>22.</td><td>Erection All Risks Insurance</td><td>Appendix-3 : Sl. No.(b)</td><td>Covering physical loss or damage to the Facilities or part thereof at the site, occurring prior to completion of the Facilities, with an extended maintenance coverage for the Contractor’s liability in respect of any loss or damage occurring during the defect liability period while the Contractor is on the site for the purpose of performing its obligations during the defect liability period. The policy shall be extended to cover Work Stoppages clause and Intermittent Testing clause.
<table>
<tr><th>Amount</th><th>Deductible Limits</th><th>Parties Insured</th><th>From To</th></tr>
<tr><td>For Domestic Bidder, Contract Price of First & Second Contract plus 25% of sum (to cover Price variation and taxes & duties etc.) of First & Second Contract Price</td><td>As per IRDA Norms</td><td>As per GCC Clause 34</td><td>From Commencement of work on Site to End of Defects Liability Period</td></tr>
</table></td><td>Appendix-3 : Sl. No.(b) is replaced as under :

<u>To be taken by Employer</u></td></tr>
<tr><td>23.</td><td>Insurance Requirements</td><td>Appendix-3 : Last Para</td><td>The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability, Workers’ Compensation and Employer’s Liability Insurances, and the Contractor’s Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Cargo, Workers’ Compensation and Employer’s Liability Insurances.
All insurer’s rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such</td><td>The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability, Workers’ Compensation and Employer’s Liability Insurances, and the Contractor’s Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor <u>& Employer</u> pursuant to GCC Sub-Clause 34.1, except for the Cargo, Workers’ Compensation and Employer’s Liability Insurances.
<u>The Contractor shall be named as co-insured</u></td></tr>
</table>

Sl. No.	Description of referred clause	Referred Clause No.	Existing Clause of Tender Document	Modified provision of Tender Document
			policies. Note: i) The losses below the deductible limit mentioned above, shall solely be the liability of the Contractor. ii) If the contractor so desires, he may cover the risks under 'Cargo Insurance', 'Third Party' & 'Erection All Risks Insurance' under one comprehensive policy.	**under Erection All Risk Policy taken by Employer pursuant to GCC Sub-Clause 34.1.** All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies. Note: i) The losses below the deductible limit mentioned above, shall solely be the liability of the Contractor. ii) If the contractor so desires, he may cover the risks under 'Cargo Insurance' **&** 'Third Party' ~~**& 'Erection All Risks Insurance**~~**'** under one comprehensive policy.

	NIT									
24.	**Critical Dates of Tender**	**NIT Clause No.1.2**	iii)	Document Download End Date & Time	11/08/2025 11:00Hrs(IST)		iii)	Document Download End Date & Time	25/08/2025 18:00Hrs(IST)
			(iv)	Online Bid Submission Start Date & Time	23/07/2025 18:55Hrs(IST)		(iv)	Online Bid Submission Start Date & Time	05/08/2025 18:55Hrs(IST)
			(vii)	Online Bid Submission End Date & Time	11/08/2025 18:00Hrs(IST)		(vii)	Online Bid Submission End Date & Time	25/08/2025 18:00Hrs(IST)
			(viii)	Last date of submission of Tender fee, EMD (Bid Security) and other offline supporting documents at "General Manager , Contracts (E&M)-III, 2nd Floor, Jyoti Sadan, NHPC Office Complex, Sector-33, Faridabad-121003 (Haryana) email: nalinikantverma@nhpc.nic.in	18/08/2025 15:00Hrs(IST)		(viii)	Last date of submission of Tender fee, EMD (Bid Security) and other offline supporting documents at "General Manager , Contracts (E&M)-III, 2nd Floor, Jyoti Sadan, NHPC Office Complex, Sector-33, Faridabad-121003 (Haryana) email: nalinikantverma@nhpc.nic.in	01/09/2025 15:00Hrs(IST)
			(ix)	Bid Opening Date & Time i. Technical bid ii. Price bid	19/08/2025 11:30 Hrs. (IST) To be intimated separately		(ix)	Bid Opening Date & Time ii. Technical bid ii. Price bid	02/09/2025 11:30 Hrs. (IST) To be intimated separately

Idma Laboratories Limited

TC-8207

TEST REPORT

Lab No.	100325L-ED-050/A		Page No. 1/2
Customer#	NHPC LIMITED Uri-I Power Station Gingle-193122 Baramulla J & K		
Type of Sample#	Surface Water (Barrage)		
Customer's Description of Sample#	Surface Water (Barrage)		
Quantity#	1 Ltr.		
Packing, Markings, Seal & Quantity#	Plastic Bottle.		
Mode of Collection of Sample	Sampling by Laboratories		
Work Order No.#	NH/UPS/2025/15	Dated	25/02/2025
Date of Receipt of Sample	10/03/2025		
Period of Analysis	10/03/2025 To 17/03/2025		
Sampling Team Idma	Idma Representative Team	Client	Mr. K.Tiwari
Sampling Location#	Barrage Site.		
Visual Observation	N/A		
Date of Sampling	04/03/2025		
Date of Reporting	17/03/2025		
Sampling Protocol	IS:17614 (PART-1):2021		
Testing Protocol	-		

RESULTS

S.No.	Test Parameter	Units	Results	Test Methods
	Chemical Testing (Water)	-	-	-
1	pH	-	7.19	IS 3025 (Part 11)
2	Conductivity	uS/cm	302	IS 3025 (Part 14)
3	Alkalinity	mg/L	124	IS 3025 (Part 23)
4	Dissolved Oxygen (DO)	mg/L	7.0	IS 3025 (Part 38)
5	Chloride	mg/L	21.1	IS 3025 (Part 32)
6	Oil & Grease	mg/L	<2.5	IS 3025 (Part 39)
7	Nitrogen (Nitrate) NO3	mg/L	1.06	IS 3025 (Part 34)
8	Total Dissolved Solids	mg/L	163	IS 3025 (Part 16)
9	Temperature	°C	24	IS 3025 (Part 9)

Reviewed by

Dipti Jain
Asst. Tech. Manager

Authorised signatory.

Kartar Singh
Tech. Mgr.

Idma Laboratories Limited
Idma Corporate Park,
391, industrial Area, Phase - 1,
Panchkula - 134113,
Haryana (India)
Tel No. 0172 - 5064827,- 5064830
Website : www.idmagroup.co.in
Email : commercial@idmalab.co.in

Disclaimer :

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- Samples not drawn by us unless otherwise stated.
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- If sample(s) not consumed, they will be stored & retained as per Company Policy / quality System Procedure.
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- In case of any feedback/complaints, please send email at testing@idmagroup.co.in or call at 0172 – 5064827 / 5064830

Idma Laboratories Limited

TC-8207

TEST REPORT

Lab No.	100325L-ED-050/A			Page No. 2/2
S.No.	Test Parameter	Units	Results	Test Methods
10	Turbidity	NTU	<1	IS 3025 (Part 10)
11	Iron as Fe	mg/L	BLQ (LOQ -0.0005)	IS 3025 (Part 53)
	Biological Testing (Water)	--	-	--
12	Total Coliform Bacteria	MPN/100ml	148	IS 1622:1981
13	Chemical Oxygen Demand	mg/L	<4	IS 3025 (Part 58)
14	Phosphorus	mg/L	0.74	IS 3025 (Part 31)

Opinion :

Represents details provided by the customer.

End of Report

Reviewed by

Idma Laboratories Ltd. Dipti Jain Asst. Tech. Manager Panchkula

Authorised signatory

Idma Laboratories Ltd. Kartar Singh Tech. Mgr. Panchkula

Idma Laboratories Limited

Idma Corporate Park,

391, industrial Area, Phase - 1,

Panchkula - 134113,

Haryana (India)

Tel No. 0172 - 5064827,- 5064830

Website : www.idmagroup.co.in

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Idma Laboratories Limited

TEST REPORT

Lab No.	100325L-ED-050/B		Page No. 1/1
Customer#	NHPC LIMITED Uri-I Power Station Gingle-193122 Baramulla J & K		
Type of Sample#	Surface Water (Barrage)		
Customer's Description of Sample#	Surface Water (Barrage)		
Quantity#	1 Ltr.		
Packing, Markings, Seal & Quantity#	Plastic Bottle.		
Mode of Collection of Sample	Sampling by Laboratories		
Work Order No.#	NH/UPS/2025/15	Dated	25/02/2025
Date of Receipt of Sample	10/03/2025		
Period of Analysis	10/03/2025 To 17/03/2025		
Sampling Team Idma	Idma Representative Team	Client	Mr. K.Tiwari
Sampling Location#	Barrage Site.		
Visual Observation	N/A		
Date of Sampling	04/03/2025		
Date of Reporting	17/03/2025		
Sampling Protocol	IS:17614 (PART-1):2021		
Testing Protocol	-		

RESULTS

S.No.	Test Parameter	Units	Results	Test Methods
1	Ca Hardness	mg/L	79.6	IS 3025 (Part 21)
2	Mg Hardness	mg/L	24.3	IS 3025 (Part 21)
3	Salinity	mg/L	87	APHA 2520 A 23rd Edition 2017

Opinion :

Represents details provided by the customer.

End of Report

17/03/25

Reviewed by

Idma Laboratories Ltd. Dipti Jain Asst. Tech. Manager Panchkula

17/3/25

Authorised signatory

Idma Laboratories Ltd. Kartar Singh Tech. Mgr. Panchkula

Idma Laboratories Limited

Idma Corporate Park,

391, industrial Area, Phase - 1,

Panchkula - 134113,

Haryana (India)

Tel No. 0172 - 5064827,- 5064830

Website : www.idmagroup.co.in

Email : commercial@idmalab.co.in

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- In case of any feedback/complaints, please send email at testing@idmagroup.co.in or call at 0172 – 5064827 / 5064830

Idma Laboratories Limited

TC-8207

TEST REPORT

Lab No.	100325L-ED-051/A		Page No. 1/2
Customer#	NHPC LIMITED Uri-I, Power Station Gingle Distt. Baramulla (J & K) 193122 Jammu & Kashmir		
Type of Sample#	Surface Water (TRT)		
Customer's Description of Sample#	Surface Water (TRT)		
Quantity#	1 Ltr.		
Packing, Markings, Seal & Quantity#	Plastic Bottle.		
Mode of Collection of Sample	Sampling by Laboratories		
Work Order No.#	NH/UPS/2025/15	Dated	25/02/2025
Date of Receipt of Sample	10/03/2025		
Period of Analysis	10/03/2025 To 17/03/2025		
Sampling Team Idma	Idma Representative Team	Client	Mr. K.Tiwari
Sampling Location#	TRT Outlet Site (power House)		
Visual Observation	N/A		
Date of Sampling	04/03/2025		
Date of Reporting	17/03/2025		
Sampling Protocol	IS:17614 (PART-1):2021		
Testing Protocol	-		

RESULTS

S.No.	Test Parameter	Units	Results	Test Methods
	Chemical Testing (Water)	-	-	-
1	pH	-	7.24	IS 3025 (Part 11)
2	Conductivity	uS/cm	298	IS 3025 (Part 14)
3	Alkalinity	mg/L	122	IS 3025 (Part 23)
4	Dissolved Oxygen (DO)	mg/L	7.1	IS 3025 (Part 38)
5	Chloride	mg/L	28.4	IS 3025 (Part 32)
6	Oil & Grease	mg/L	<2.5	IS 3025 (Part 39)
7	Nitrogen (Nitrate) NO3	mg/L	1.09	IS 3025 (Part 34)
8	Total Dissolved Solids	mg/L	177	IS 3025 (Part 16)
9	Temperature	°C	24	IS 3025 (Part 9)

Reviewed by

Authorised signatory

Idma Laboratories Ltd. Kartar Singh Tech. Mgr. Panchkula

Idma Laboratories Limited
Idma Corporate Park,
391, industrial Area, Phase - 1,
Panchkula - 134113,
Haryana (India)
Tel No. 0172 - 5064827,- 5064830
Website : www.idmagroup.co.in
Email : commercial@idmalab.co.in

Disclaimer :

- The Test Report is only for the sample tested.
- Samples not drawn by us unless otherwise stated.
- Total liability of Idma Laboratories Limited is limited to the invoiced amount.
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- In case of any feedback/complaints, please send email at testing@idmagroup.co.in or call at 0172 – 5064827 / 5064830

Idma Laboratories Limited

TC-8207

TEST REPORT

Lab No.	100325L-ED-051/A			Page No. 2/2
S.No.	Test Parameter	Units	Results	Test Methods
10	Turbidity	NTU	<1	IS 3025 (Part 10)
11	Iron as Fe	mg/L	BLQ (LOQ -0.0005)	IS 3025 (Part 53)
	Biological Testing (Water)	--	-	--
12	Total Coliform Bacteria	MPN/100ml	109	IS 1622:1981
13	Chemical Oxygen Demand	mg/L	<4	IS 3025 (Part 58)
14	Phosphorus	mg/L	0.57	IS 3025 (Part 31)

Opinion :

Represents details provided by the customer.

End of Report

Reviewed by

Authorised signatory

Idma Laboratories Limited

Idma Corporate Park,

391, industrial Area, Phase - 1,

Panchkula - 134113,

Haryana (India)

Tel No. 0172 - 5064827,- 5064830

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Idma Laboratories Limited

TEST REPORT

Lab No.	100325L-ED-051/B		Page No. 1/1
Customer#	NHPC LIMITED Uri-I, Power Station Gingle Distt. Baramulla (J & K) 193122 Jammu & Kashmir		
Type of Sample#	Surface Water (TRT)		
Customer's Description of Sample#	Surface Water (TRT)		
Quantity#	1 Ltr.		
Packing, Markings, Seal & Quantity#	Plastic Bottle.		
Mode of Collection of Sample	Sampling by Laboratories		
Work Order No.#	NH/UPS/2025/15	Dated	25/02/2025
Date of Receipt of Sample	10/03/2025		
Period of Analysis	10/03/2025 To 17/03/2025		
Sampling Team Idma	Idma Representative Team	Client	Mr. K.Tiwari
Sampling Location#	TRT Outlet Site (power House)		
Visual Observation	N/A		
Date of Sampling	04/03/2025		
Date of Reporting	17/03/2025		
Sampling Protocol	IS:17614 (PART-1):2021		
Testing Protocol	-		

RESULTS

S.No.	Test Parameter	Units	Results	Test Methods
1	Calcium Hardness	mg/L	79.5	IS 3025 (Part 21)
2	Magnesium Hardness	mg/L	26.1	IS 3025 (Part 21)
3	Salinity	mg/L	86	APHA 2520 A 23rd Edition 2017

Opinion :

Represents details provided by the customer.

End of Report

Reviewed by

Idma Laboratories Ltd. Dipti Jain Asst. Tech. Manager Panchkula

Authorised signatory

Idma Laboratories Ltd. Kartar Singh Tech. Mgr. Panchkula

Idma Laboratories Limited

Idma Corporate Park,

391, industrial Area, Phase - 1,

Panchkula - 134113,

Haryana (India)

Tel No. 0172 - 5064827,- 5064830

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Annexure-B1 of GCC

No. 15-18/1/2020-HYDEL-II(MoP)-Part(1)
Government of India
Ministry of Power
****

Shram Shakti Bhawan, Rafi Marg
New Delhi, 29th November, 2021

OFFICE MEMORANDUM

Subject: "Dispute Avoidance Mechanism" through 'Independent Engineer' (IE) in the Contracts of CPSEs under administrative control of Ministry of Power executing Hydro Power Projects – Panel of Experts.

Reference is invited to this Ministry's O.M. No. 15-18/1/2020-HYDEL-II(MoP) dated 27.09.2021 regarding the Model Contract Provision for 'Dispute Avoidance Mechanism' through "Independent Engineer" in the Construction Contracts of CPSEs under administrative control of this Ministry executing Hydro Power Projects. Reference is also invited to this Ministry's O.M. No. 15-18/1/2020-H-II dated 05.10.2021, vide which the 'Expression of Interest' was invited from eligible candidate(s) for empanelment as 'Independent Engineer'.

2. In this connection, the undersigned is directed to convey that the Competent Authority has approved the following Panel of Experts as "Independent Engineer" :

S. No.	Name	Date of Birth	Post held immediately before retirement	Contact Details
1	Ravinder Kumar Sharma	10.02.1947	CMD, THDC India Limited	9810137215 rks98101@hotmail.com
2	Chander Mohan Walia	10.11.1949	Director (Electrical), HPPCL and Member (Technical), HPSEB	9418031231 cmwalia1949@gmail.com
3	Arun Kumar	22.12.1950	Member (Projects), HP State Electricity Board	9816600130 arunkumar@jayahydro.com

Annexure-B1 of GCC

4	Dr. A.K. Lomas	18.09.1951	CMD, MECL and ED, NHPC Ltd.	9810212274 aklomas@gmail.com
5	Vinod Kumar Kapoor	21.07.1954	ED, NHPC; President/ Project Management Engineer for Hydropower Projects, Bhilwara Energy Ltd.	9599207052/ 9958466211 kapoorveekay@yahoo.co.in
6	Om Prakash	01.04.1957	Executive Director, NHPC Ltd.	8527724400 omprakash1957@gmail.com
7	Krishna Deo Sah	04.07.1957	Executive Director, NHPC Ltd.	9797793514 kdsah.2008@rediffmail.com
8	P.P.S. Mann	09.06.1957	Executive Director, THDC India Ltd. & Head of Project of Tehri Power Complex.	7351901352/ 7277630000 pps3mann@gmail.com
9	Rajesh Kumar Chaudhary	19.11.1957	Executive Director, NHPC Ltd.	9650088562 rajesh1957chaudhary@gmail.com
10	Ramesh Narain Misra	20.11.1957	CMD, SJVN Ltd.	9958111243 rnmisra1957@gmail.com
11	Janki Prasad	14.12.1957	Chief Engineer (HPM), Central Electricity Authority, New Delhi	9868555133 jpg57@rediffmail.com
12	Kanwar Singh	13.03.1959	Director (Civil), SJVN Ltd.	9810519883 kanwarsinghpc@yahoo.co.in ksnhpc@gmail.com
13	Rakesh	20.05.1960	Executive Director, NHPC Ltd.	8811072000 9810330826 rake_sh@hotmail.com
14	Anand Kumar Gupta	15.07.1960	Director (Commercial), NTPC Limited	9650992233 akgupta521@gmail.com

Annexure-B1 of GCC

15	Rajesh Kumar Jaiswal	29.09.1960	Executive Director, NHPC Ltd.	8826006998 rajesh9285@gmail.com
16	Muhar Mani	14.12.1960	Executive Director (OMS, QA, Safety/Corporate Planning Monitoring & project Service), THDC, Rishikesh	9411106931 manimuhar@gmail.com
17	Kanwar Pal Singh	01.03.1961	Executive Director, Engineer in Charge of Tehri Pumped Storage Plant and Vishnugad Pipalkoti H.E. Project, THDC India Limited.	9412076324 kpstomar@rediffmail.com
18	Dhirendra Veer Singh	02.04.1961	CMD, THDC India Limited	9411103546 dvsingh01@yahoo.com
19	Suresh Chandra Pal	04.07.1961	Executive Director, NHPC Ltd.	7042711944 scpal02@yahoo.com

3. It is suggested that the Independent Engineer be chosen as per their background and relevant experience. All other terms and conditions shall be governed by this Ministry's O.M. No. 15-18/1/2020-HYDEL-II(MoP) dated 27.09.2021 and O.M. No. 15-18/1/2020-H-II dated 05.10.2021, as amended from time to time.

This issues with the approval of the Competent Authority.

(R. P. Pradhan)
Director (Hydro-II)
Email: rp.pradhan@nic.in

In-Charge, NIC Cell – for publication on the website of Ministry of Power.

Copy to:

1. The Chairperson, Central Electricity Authority, New Delhi
2. The Chairperson, Central Water Commission, New Delhi
3. Member (Hydro), Central Electricity Authority, New Delhi
4. CMDs of all the CPSUs under Ministry of Power executing Hydro Power Projects.

Copy for information to:

1. O/o Hon'ble Minister of Power and New & Renewable Energy.
2. O/o Hon'ble Minister of State for Power.
3. Sr. PPS to Secretary (Power) / Sr. PPS to AS(SKG) / Sr. PPS to AS&FA / Sr. PPS to AS(VKD)
4. All Joint Secretaries / equivalent level Officers of Ministry of Power
5. All Directors / Deputy Secretaries of Ministry of Power

AMENDMENTS AUTHORISED FOR LOT-III E&M WORKS PACKAGE 240 MW (2X120MW) Uri-I Stage-II H.E Project, Baramulla District of UT of J&K, India

Tender Reference No.: NH/Conts(EnM)-III/Uri-I Stage-II/ENM/2025/01 & ID No. 2025_NHPC_861342_1

Sl. no.	Clause No.	Authorised Amendments
A. Vol-IIIA (GENERAL TECHNICAL SPECIFICATIONS):		
1	Vol-IIIA (GTS)/Cl.no 5.7.4	Check valves of size 150 mm and above shall be dashpot assisted check valves ad size below 150 mm dual plate check valve (silent type) shall be used. All flanges shall be grooved type with O ring arrangement added.'
B. Vol-IIIB (PARTICULAR TECHNICAL SPECIFICATIONS):		
1. GENERAL TECHNICAL REQUIREMENTS		
1	Vol-IIIB (PTS), Cl.no 1.5.1.6	New para is added : As per DPR Maximum dimension (L x W x H) of packages for transport i.e. transformer–4000mm X 3500mm X 4500 mm approx. Maximum weight of the package i.e. transformer which would be transported–60 T approx.
2. TURBINE AND ACCESSORIES		
Chapter 2 is updated and replaced as attached Attachment 1_Technical_D_Amendment_01		
3.DIGITAL GOVERNING SYSTEM AND ACCESSORIES		
1	Cl. no. 3.5.7.1	Text 'motor driven screw / vane /gear pumps' is substituted by 'motor driven screw / vane / Piston pumps'.
2	Cl. no. 3.5.7.1	Text ' screw / vane /gear pumps' is substituted by ' screw / vane / Piston pumps'.
3	Cl. no. 3.5.8.1	Text 'The piston accumulator and N2 bottles shall have a total volume of at least fifteen (15) times the combined… is deleted' **and substituted by** 'The size of the accumulator shall be such that it shall be possible to operate the guide vanes 3 times (2 "C"+1 "O") from minimum normal working /operating oil pressure to minimum allowable pressure without the operation of governor oil pumps and without dry nitrogen admission and shall be designed for a pressure ten (10) percent above the actual maximum system pressure. At the remaining pressure, the governing mechanism should still operate with a safe margin. Design of the piston accumulator shall be such that the same shall be accommodated on the turbine floor'
4. MIV		
Chapter 4 is updated and replaced as attached Attachment 2 _Technical_D_Amendment_01		
5. GENERATOR		

<table>
<tr><td>1</td><td>Vol-IIIB (PTS) 5-17
Cl.no 5.5.12.4</td><td>Text ‘clock speed (range of 800-1000 MHz)’ is substituted by ‘suitable clock speed’.</td></tr>
<tr><td>2</td><td>Vol-IIIB (PTS)/Cl. No 5.3.1</td><td>The data in table at S no is 13 is deleted and substituted by following :
<table>
<tr><td>13 (i)</td><td>Maximum permissible temperatures under rated Power (120MW) at 0.9 p.f at rated voltage and rated frequency with ambient temperature 40ºC and cooling water inlet temperature 30ºC</td><td>Absolute Temperature</td></tr>
<tr><td>A</td><td>Stator winding</td><td>105ºC</td></tr>
<tr><td>B</td><td>Rotor winding</td><td>105ºC</td></tr>
<tr><td>C</td><td>Thrust bearing pads</td><td>75ºC</td></tr>
<tr><td>D</td><td>Guide bearing segments</td><td>65ºC</td></tr>
<tr><td>E</td><td>Stator Core</td><td>70ºC</td></tr>
<tr><td>13 (ii)</td><td>Maximum permissible temperatures under maximum Power (155.3 MVA) with ambient temperature 40ºC and cooling water inlet temperature 30ºC</td><td>Absolute Temperature</td></tr>
<tr><td>A</td><td>Stator winding</td><td>120ºC</td></tr>
<tr><td>B</td><td>Rotor winding</td><td>130ºC</td></tr>
<tr><td>C</td><td>Thrust bearing pads</td><td>80ºC</td></tr>
<tr><td>D</td><td>Guide bearing segments</td><td>70ºC</td></tr>
<tr><td>E</td><td>Stator Core</td><td>75ºC</td></tr>
</table></td></tr>
<tr><td>3</td><td>Vol-IIIB (PTS)/Cl. No 5.3.1</td><td>Data of Short circuit ratio at s. no 10 is deleted and substituted by ‘Not less than 1.05 at 0.9 pf’</td></tr>
<tr><td></td><td>Vol-IIIB (PTS)5.4.2</td><td>Expression for “ ηgAv” is revised as ηgAv =0.1 ηg110 + 0.8 ηg100 + 0.1 ηg75</td></tr>
<tr><td>4</td><td>Vol-IIIB (PTS)5.5.2</td><td>The data at sr. no 6 and 8 of the table is updated as under:
Text “ASTM A 516 GR 70” at sr. no 6 & 8 of the table is substituted as “ASTM A516 GR 70/ IS 2062 E350</td></tr>
</table>

5	Vol-IIIB (PTS) 5.5.9	Text "Oil retaining sleeve arrgt. of proven design in bearing housings to arrest the oil leakage shall be provided by the contractor. The same shall be finalized during detail engineering" **is added** after para 10 of the clause.
8. GSU TRANSFORMER		
1	Vol-IIIB (PTS)/Clause 8.3 sub clause 11a	Text 'Oil/Oil bushing' i**s substituted by 'O**il/SF6 bushing'.
2	Vol-IIIB (PTS)/Clause 8.5.4.1	Text' All the HV, LV & Neutral bushing shall be RIP……..(With Polymer housing)' is deleted and substituted by All the LV & Neutral bushing shall be supplied as per requirement. All the HV bushing shall be RIP (Resin Impregnated paper (with polymer housing)/RIS(Resign Impregnated Synthetic(With Polymer housing).
3	Vol-IIIB (PTS)/ Clause 8.5.13	Text 'All Valve up to 50 NB, shall be of Gun Metal/cast steel and valves above 50 NB shall be of Cast steel body with stem ,body ring, wedge facing ring etc. of stainless steel is **added in 1st para after first line**.
7. BUS DUCT		
1.	Vol-IIIB (PTS)/ Clause 7.1.1 SUB Clause xv)	Text 'One(1) set ' **is substituted by** ' Two(2) set'.
9. BUS REACTOR		
1	Vol-IIIB (PTS)/ Cl.no 9.5.4.1	Text 'All the line & neutral bushing shall be supplied as per requirement is deleted' and substituted by All the LV & Neutral bushing shall be supplied as per requirement. HV bushing shall be RIP(Resin Impregnated paper (with polymer housing)/RIS(Resign Impregnated Synthetic(With Polymer housing).
11.GAS INSULATED SWITCHGEAR		
1	Vol-IIIB (PTS)/ Clause 11.5.5	Text "The contractor .....during detail engineering" is deleted and substituted by "The contractor can propose any other equivalent/ better arrangement in line with Annex-F of latest version of IEC 62271-203 and the same shall be finalized during detail engineering."
2	Vol-IIIB (PTS)/ Clause 11.5.12	Text "group operated " is deleted and substituted by "individual/group operated"
13.DC SYSTEM		
Chapter 13 is updated and replaced as attached Attachment 3_Technical_D_Amendment_01		
14. CMR		
1	Vol-IIIB (PTS) Cl.no 14.5.5.5 Temperature measurement	Complete content of Clause 14.5.5.5 is deleted and substituted by All RTDs for measuring and monitoring temperature of Stator core, teeth, winding, bearing (Pad & Oil), CW, Hot air etc and for other systems shall be integrated with SCADA. The controller shall acquire these signals through RTD cards of the I/O rack and shall be suitably depicted in mimic. Alarm/trip settings for high temperature shall

		be adjustable over the entire range. Temperature measurements shall also be available on the HMI of the UCB and shall be printed out in the control room on demand. "Refer Revised and substituted Chapter 14 attached as Attachment 4_Technical_D_Amendment_01 "
2	Vol-IIIB (PTS)/Cl.no 14.2.1	Text '4-20 mA output in addition to local ' is deleted. " Refer Revised and substituted Chapter 14 attached as Attachment 4_Technical_D_Amendment_01 "
3	Vol-IIIB (PTS)/Cl no 14.1.2 sub clause viii)	Sub Clause viii) of clause 14.1.2 stands deleted " Refer Revised and substituted Chapter 14 attached as Attachment 4_Technical_D_Amendment_01 "
4	Vol-IIIB (PTS) /Cl. No 14.5.9	Complete clause 14.5.9 along with its sub-clauses stands deleted. " Refer Revised and substituted Chapter 14 attached as Attachment 4_Technical_D_Amendment_01 "
24. COOLING WATER SYSTEM		
1	Vol-IIIB (PTS) Cl.no 24.5.6	Text ' Fastener used for supports of pipelines shall be chemically grouted through anchor fasteners and heavy-duty supports shall be provided for the same. Check valves of sixe 150 mm and above shall be dashpot assisted check valves and size below 150 mm dual plate check valve (silent type) shall be used.
2	Vol-IIIB (PTS)/Cl.no 24.3.1	Para 'The design capacity of the above …. head loss in the circuit.' is deleted.
25. DRAINAGE AND DEWATERING SYSTEM		
1	Vol-IIIB (PTS)/ Cl.no 25.5.3	Text ' Fastener used for supports of pipelines shall be chemically grouted through anchor fasteners and heavy-duty supports shall be provided for the same. Check valves of sixe 150 mm and above shall be dashpot assisted check valves ad size below 150 mm dual plate check valve (silent type) shall be used. All flanges shall be grooved type with O ring arrangement'. is added.
2	Vol-IIIB (PTS)/Cl.no 25.2.1.5	First Para in the text 'to DT gate downstream' is deleted and substituted by 'to river via MAT'.
26. HVAC		
1	Vol-IIIB (PTS)/ Cl.no 26.5.8	Text ' Valve size above DN200 shall also be provided with manual gear drive arrangement for ease of operation. Fastener used for supports of pipelines shall be chemically grouted through anchor fasteners and heavy-duty supports shall be provided for the same. Check valves of size 150 mm and above shall be dashpot assisted check valves and size below 150 mm dual plate check valve (silent type) shall be used. All flanges shall be grooved type with O ring arrangement', is added.
29. FIRE FIGHTING SYSTEM		
1	Vol-IIIB (PTS) /Cl.no 29.5.6	Text "Mechanical groove …..detailed engineering." is deleted and substituted by ' Fastener used for supports of pipelines shall be chemically grouted through anchor fasteners and heavy-duty supports shall be provided for the same. Check valves of size 150 mm and above shall be dashpot assisted check valves ad size below 150 mm dual plate check valve (silent type) shall be used. All flanges shall be of grooved type with O-ring arrangement.
Vol-IIIC (TECHNICAL DATA SHEETS		

1	Vol III C /TDS	Complete data Sheet is revised and replaced as attached Attachment 6_Technical_D_Amendment_01
Vol-IV Drawings:		
1	Vol-IV/ Cooling water system drawing	Dwg NH/DEM/URI I STG-II/CW/01 is revised and replaced.
2	Vol-IV /Firefighting system	Dwg NH/DEM/URI I STG-II/FF/01 is revised and replaced.
3	Vol-IV/DC system	Dwg NH/DEM/URI I ST II/DC/01 SH 1 of 2 revised and replaced. Dwg NH/DEM/URI I ST II/DC/02 SH 2 of 2 New dwg added Dwg NH/DEM/URI I ST II/DC/02 New dwg added
4	Vol-IV/415 System Drawing	Dwg NH/DEM /URI-I STG-II/LT-01 is revised and replaced
5	Vol-IV /SLD MV Switchgear & Auxiliary Transformer	Dwg NH/DEM /URI-I STG-II/CP/05 is revised and replaced
6	Vol-IV /CT PT Details of Bus Duct	Dwg NH/DEM /URI-I STG-II/BD/01 is revised and replaced
7	Vol-IV/PROTECTIVE RELAYING & METERING DIAGRAM Sh 2 of 2	Dwg NH/DEM /URI-I STG-II/CP/01 is revised and replaced
Note: Complete Volume-IV-Drawings including above revised drawings is substituted as attached Attachment 7_Technical_D_Amendment_01		
ATTACHMENT 5 (Volume-V-Forms & Procedures)		
1	Attachment 5 A	Complete Vendor List has been updated and substituted as Attachment 5A_Technical_D_Amendment_01
2	Attachment 5 B	Complete Specific qualification criteria is updated and substituted as Attachment 5B_Technical_D_Amendment_01

2 TURBINE AND ACCESSORIES

2.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, model testing, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Employer's personnel, handing over to Employer and guarantee for two years of Two (2) sets of vertical shaft Francis Turbines as per the specifications hereunder, each complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

2.1.1 Vertical shaft Francis Turbine and accessories

1) Two (2) sets of vertical shaft Francis Turbines, each having a rated output of not less than 121.827 MW at rated design head of 227.0 metres at guide vane opening not more than 85%, shall be complete and comprising of following main components:

i) Fixed/embedded components including Draft tube liner, Dewatering arrangement, Stay ring, Spiral case, embedded piping and foundation parts,

ii) Stationary, removable components including Draft tube cone, Discharge ring, Bottom ring, Head cover, Stationary labyrinths, Guide apparatus, Guide bearing and Shaft sealing arrangement,

iii) Rotating components including Runner, Moving labyrinths, runner cone and turbine shaft etc,

iv) Runner/turbine shaft and turbine shaft/generator shaft coupling bolts

2) Two (2) sets of Pit liners,

3) Two (2) sets of anchors, turn-buckles, fixtures, machine pads, base plates, jacks and foundation bolts, rails etc.

4) Two (2) sets of Self Lubricated Bearing System for GV bushes

5) Two (2) sets of Turbine pit drainage complete with submersible pumps, piping, fitting, level controllers and accessories etc.

6) Two(2) sets of Turbine pit monorail hoists, platforms, walkways, handrails, stairs, cover plates, access doors, acoustic barriers, floor gratings / hatch cover on all floor opening for runner handling etc.

7) Two (2) sets of draft tube plugs.

8) Necessary arrangement for pressure, flow measurement for carrying out field efficiency test on one turbine

9) Two (2) sets of necessary fittings / piping / accessories etc.

10) Two (2) sets of Winter – Kennedy flow measurement system and ultrasonic continuous on-line flow measurement system along with required numbers of transducers/ sensors and associated accessories for measuring, monitoring and data acquisition and integration of the system with plant SCADA system

11) Two (2) sets of fixed type online and Two (2) sets of portable optical type silt measuring instruments to indicate and record the silt content of the water passing through the Turbine

12) All necessary items / equipment for synchronous condenser mode operation

13) Two (2) sets of all necessary control, monitoring, safety and metering instruments/devices/system including interfacing with plant SCADA

14) One(1) set of handling devices / slings etc for Runner, Runner Cone / Bottom ring / Guide vane / Draft tube cone / labyrinths etc., motorized runner handling carts for dismantling of underwater components from bottom including runner handling cart.

15) One (1) set of runner inspection platform sectionalised into components including scaffolding which can be manually handled though draft tube manhole door.

16) One hydraulic scissor platform of suitable size shall also be provided for runner inspection.

17) Two (2) sets of runner removal hatch cover as per clause no 4.11.2 of GTS

18) Two (2), lot of Turbine oil, lubricants etc. for first filling of all components with 10% extra quantity, in non-returnable drums, for all four (4) units,

19) Hard coating as per PTS clause no 2.5.9.

20) Spare parts in accordance to clause 2.8 “Spare Parts” of this section.

21) Tools and instruments in accordance to clause 2.9 “Tools and Instruments” of this section

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

2.2 Specific Parameters and Layout Conditions

2.2.1 Water conductor system

The main components of water conductor system are as follows:

POWER INTAKE

Number	:	2 , One no for Uri I PS & other for Uri-I Stage -II
Size of Opening	:	7.0 m x 9.0 m
Invert Level	:	EL. 1462.5 m
Trash Rack	:	Steel Trash Rack

Trash Rack Size	:	33.4 m (W) x 15.8 m (H)

PRESSURE SHAFT

No. & Diameter	:	1 Nos. 5 m (Internal)
Shape & Type	:	Underground Circular Steel Lined
Design Discharge(each Penstock)	:	117.15 cumec
Length	:	230 m(Horizontal) , 220 m(Vertical)

PENSTOCK

Number & Type	: 2 Nos.,Underground Circular Steel Lined
Diameter	: 3.25m
Length	: PS-1=30m,PS-2=40m
Discharge	: 58.58Cumecs

TAILRACE TUNNEL

No. & Type	:	1 No. & Underground Concrete Lined
Dia. & Shape	:	6.5 m, Horse Shoe Shaped
Design Discharge	:	117.15 cumec
Length of TRT	:	2280 m

2.2.2 Hydraulic conditions

The hydraulic conditions under which the turbine shall be operated are given below:

i	Full Reservoir Level (FRL)	EL 1491.00 M
ii	Minimum Draw Down level (MDDL)	EL 1491.00 M
iii	Maximum tail water level (with all unit operation at full load)	EL 1241.00 M
iv	Minimum tail water level (with one unit running at no load)	EL 1241.00 M

v	Maximum Head Loss	23.0 m at rated discharge
vi	Operating conditions	Continuous operation depending on availability of discharge
ix	**Operating range of net heads**	
a	Rated net head	227.0 m
b	Maximum net head	227.0 m
c	Minimum net head	227.0 m

2.2.3 Design considerations

2.2.3.1 Power House Layout

The project is envisaged as an underground power house having two vertical-shaft generating units, each comprising of a Francis turbine directly coupled to a synchronous generator.

Layout of power house and general arrangement of generating units and other equipment, details of water conductor system have been outlined in the layout drawings.

The centreline of the turbine has been fixed at EL 1228.70 M.

2.2.3.2 Assembly and disassembly

Turbine may require frequent disassembly for repair. The Contractor shall design the turbine such that disassembly and assembly of the upper/lower draft tube cones, guide vanes, bottom ring, runner, guide vane lower bearings etc. can be done from below the turbine without disturbing the generator components. Height of various components i.e. upper/lower draft tube cones shall be as per the available site space for smooth removal of runner without any hindrance.

The runner, after dismantling from the turbine shaft, shall be lowered and clamped on the runner-handling cart for which suitable arrangement shall be provided. The runner-handling cart shall be taken out under the hatch and runner shall be lifted by the power house EOT crane and be taken to service bay at EL 1239.8 M. Other turbine components shall also be handled through the cart.

2.2.3.3 Special design considerations

i) The turbine and/or generating unit shall be designed to withstand the additional stresses resulting from operation of unit with three adjacent guide vane passages in blocked condition. The Contractor shall provide calculation to substantiate the provision in design for this aspect during detailed engineering.

ii) The discharge ring / bottom ring shall be designed to support the runner and shaft when disconnected from the generator, if applicable.

iii) The turbine guide bearing lubricating oil and governor oil shall be of the same specification as the generator bearing oil.

iv) The turbine shall be designed for direct coupling to 141.176 MVA, 0.85 power factor, 50 Hz with frequency variation -5% to +3%, 333.33 rpm synchronous vertical shaft generator.

v) Inertia constant of complete generating unit at maximum output shall not be less than 3.75kW-Sec/KVA.

vi) The turbine shall be designed suitably for automated and continuous operation of the units in Synchronous Condenser Mode Operation also. All the turbines shall be provided with necessary arrangements such as cooling arrangements for runner & seals, water drainage & air release arrangements, tail water depression system, piping arrangements etc., so that the units can be operated hassle free in synchronous condenser mode continuously. Suction cone water level monitoring equipment, control valves and other required control elements / items with suitable interfacings shall be provided for automated operation of the units in synchronous mode of operation.

2.2.3.4 Noise

The maximum noise level at any place at 1.0 m (One meter) distance shall not exceed 90 dB.

2.2.3.5 Silt erosion considerations and petrographic analysis

The project is situated in Himalayan region where the silt content during high flow period is excessive and peaks abnormally during high flood. Even though material specification have been included and it is not the intention to ask guarantee yet it is mentioned that turbine is expected to operate under silt concentration (detailed as per “Enclosure-1”) during high flood. The petrographic analysis of silt in water and chemical analysis of water is detailed in “Section 1, Enclosure- 1”.

The Contractor shall critically study the silt data and chemical analysis of water and take the same into account in designing the turbine and auxiliary equipment susceptible to abrasive effect of silt and making all such specific provisions so as to minimise the effect of silt.

2.2.4 Construction Methodology

EOT columns are envisaged to be raised on standalone basis. The crane beam shall be constructed and handed over for installation of main EOT crane prior to erection of spiral casing. It is however, envisaged that civil contractor would install a temporary EOT crane of approx. 20 T capacity for his works in powerhouse. The temporary crane shall also be available to E&M contractor for erection of the draft tube and other E&M works with mutual agreement on requirement basis.

2.3 Rating and Functional Characteristics

2.3.1 Turbine rating

Each turbine shall have a rated output of not less than 121.827 MW at shaft coupling and at rated speed of 333.33 rpm when operated at a rated net head of 227.0 m within 85% guide vane opening. It shall also be capable of delivering 110% continuous rated output at rated net head.

2.3.2 Rated speed

The speed of the units shall be 333.33 rpm in clockwise direction when viewed from top.

2.3.3 Pressure Rise and speed rise

The maximum pressure rise at turbine inlet, considering the effect of water hammer under worst conditions of load acceptance/rejection and governor closing/opening times shall be indicated by the Contractor. However, the pressure rise shall not be more than 29% of the static head at 262.3 Head and speed rise shall not be more than 55% of the synchronous speed i.e., 333.33 rpm under any worst condition.

2.3.4 Runaway speed

The generating unit shall be designed to withstand the forces and stresses occurring at maximum runaway speed condition for a period of at least Fifteen (15) minutes without any damage and to safely withstand any transient over speeds.

2.4 Performance Guarantee

The generating units along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

Field tests shall form the final basis to establish fulfilment of guarantee of the turbine and for purposes of liquidated damages and rejection of the plant.

2.4.1 Guaranteed output

The Contractor shall guarantee the following turbine outputs at shaft coupling at rated speed of 333.33 rpm:

i) Rated output not less than 121.827 MW at a rated net head of 227.0 m and within 85% guide vane opening,

ii) Full gate output of not less than 134 MW at a rated net head of 227.0 m.

2.4.2 Guaranteed efficiency

The guaranteed weighted average efficiency at the rated net head shall not be less than 94 percent with coated runner and 94.3% with uncoated runner and shall be calculated as follows:

$$\eta_{a\,w} = 0.1 \times \eta_{110} + 0.8 \times \eta_{100} + 0.1 \times \eta_{75}$$

where,

$\eta_{a\,w}$ = Weighted average efficiency

η_{110} = Efficiency at 110 percent of rated output when operating at net head of 227.0m

η_{100} = Efficiency at 100 percent of rated output when operating at net head of 227.0 m

η_{75} = Efficiency at 75 percent of rated output when operating at net head of 227.0 m

Liquidated damages shall be considered for coated runner bid value and all the loading shall be done on the value provided for coated runner only. Liquidated damages shall be imposed as per Clause 2.4.4, “Liquidated damages for shortfall in output and efficiency” in case of shortfall in weighted average efficiency vis-à-vis the corresponding guaranteed value.

The liquidated damages on account of shortfall in weighted average efficiency shall be computed separately for each unit and the total amount of liquidated damages shall be the sum of all the units.

However, tolerance in computation of efficiency shall be in accordance with the IEC 60041-1991 for field acceptance test for hydraulic turbines.

2.4.3 Cavitation pitting guarantee

The Contractor shall guarantee that pitting due to cavitation, during a period of 24 (twenty four) months or 8000 operating hours, whichever is earlier, from the date the unit is placed in to commercial operation, will not impair the strength of the runner or be measurably detrimental to the efficiency or power output of the turbine. Out of 8000 hours of operation, 500 hours of operation may be at less than 50% of rated load.

A) For stainless steel runner

The material loss during this period shall not exceed the weight as calculated by the following formulae.

$$m = kD^2/8000$$

Where: m = metal loss rate, kg/h

D = runner outlet diameter, m

k = 0.6

B) For all other turbine parts combined - stay ring, guide vanes, head cover, bottom ring, discharge ring and draft tube liner.

i) An average metal loss rate, calculated by the formula above using a value of k = 0.6 on the basis of the total metal loss divided by the number of operating hours,

ii) Any single continuous area of 25 cm^2 or larger to an average depth of 3 mm.

If any of the runner passages or any individual turbine component separately listed above fails to meet the above guarantee, the Contractor shall, at his own expense, repair the pitted area by welding and also repair in a satisfactory manner all other areas, at the same location, of other water passages or identical turbine components where similar damage due to the same cause may have occurred although to a lesser extent.

The Contractor shall also make the necessary alterations to remove the cause or causes of the pitting or, if necessary, shall replace the runner. Subsequent to repair, the repaired runner and turbine components will be subject to the above pitting guarantee for another period of 8,000 operating hours of power production. The guarantee will be renewed each time the turbine fails to meet the guarantee. Cavitation inspection will be carried out after first year or after 4000 hours of operation, whichever is earlier, at which time the Contractor can assess the amount of damage and effect minor corrections

2.4.4 Liquidated damages for shortfall in output and efficiency

For any shortfall in the tested values of rated output and the weighted average efficiency of turbine vis-à-vis the corresponding guaranteed values respectively, shall be computed as follows:

A) Output

For each one tenth of one percent (0.1%) shortfall in tested value of rated output of not less than 121.827 MW at a net head of 227.0 m vis-à-vis corresponding guaranteed value	**@ INR 32,62,800**

B) Weighted average efficiency

For each one tenth of one percent (0.1%) shortfall in tested value of weighted average efficiency vis-à-vis corresponding guaranteed value	**@ INR 32,62,800**

For fractional values of shortfalls in percentage, the liquidated damages amount will be computed on pro-rata basis. The guaranteed efficiency figure shall be quoted upto “1” decimal places. In case any bidder has quoted in two decimals points, then value at second decimal point shall 0 not be considered.

The liquidated damages on account of shortfall of output and weighted average efficiency shall be computed separately. The total amount of liquidated damages shall be the sum of these two multiplied by number of turbines.

No tolerance limits shall be permissible over the calculated value of rated output. However, tolerance in computation in efficiency shall be in accordance with the IEC 60041-1991 for field acceptance tests for hydraulic turbines.

2.4.5 Rejection limit

The Employer reserves the right to reject the turbine if the tested values of either weighted average efficiency or the rated output (not less than 121.827 MW) at rated net head of 227.0 m falls short by two (2) percent or more of the corresponding guaranteed values during field acceptance tests.

2.4.6 Model acceptance tests

2.4.6.1 General

Turbine model test shall be performed in an approved test laboratory in presence of a team of the Employer, to demonstrate that the efficiency and other guarantees, as well as the requirements of the specifications for the performance of the turbine, will be met.

The model test shall be conducted within nine months following the award of the contract and six (6) hard copies of the “Model Test Report” and six (6) soft copies shall be submitted for perusal of the Employer.

The tests shall be as per latest IEC test code publication No. 60193 “International code for Model Acceptance Test of Hydraulic Turbines”. The step-up of the model efficiency to the prototype efficiency shall be in accordance with IEC Publication 60193.

Model test results shall be subject to the approval of the Employer and the Contractor shall commence manufacture of the prototype after approval for the same has been accorded.

2.4.6.2 Place of model test

The laboratories proposed shall be accredited by reputed agencies. The list of laboratories shall be got approved from the employer before proceeding for the model test. Employer reserves the right to get the model tested in any of the renowned approved test laboratory or Contractor’s facilities/ recommended agencies by the Contractor.

In case model tests are conducted at the Contractor’s facilities, the Contractor shall guarantee the repeatability of the results within the allowance provided in IEC. Nevertheless the Employer reserves the right to get the model test repeated in presence of both the parties in an internationally recognised independent laboratory at his own cost.

The Contractor shall supply his model test data, method of testing from previous tests and turbine model, for each component of turbine, to the laboratory selected for conducting the tests, if it is different than the Contractor’s facilities.

2.4.6.3 Tests to be conducted on model

The model tests shall be conducted in range of unit speeds corresponding to 65 % to 125 % of rated head and guide vane opening corresponding to no-load to 100% guide vane opening. The guide vane positions shall be superimposed on the efficiency contours. The model 'hill' diagram shall show unit flow / unit power versus unit speed or head with lines of constant efficiency, power, gate position and cavitation limits. The prototype 'hill' diagram shall show prototype power output versus head with lines of constant efficiency, flow, gate position and cavitation limits. Prototype curves of efficiency, flow and gate position versus power output shall be made for net heads corresponding to 65% to 125% of rated head. Guide vane torque, Axial thrust at various operating points at each guide vane opening shall be measured and plotted on model and prototype hill chart.

The cavitation limits, runaway speed characteristics, hydraulic thrust, guide vane torque and draft tube vortex phenomena shall be determined by the laboratory tests on model.

The efficiency characteristics of the homologous turbine shall also be determined and the complete 'hill' diagrams of both model and prototype shall be incorporated in the report.

The step-up of the model efficiency to the prototype efficiency shall be in accordance with IEC 60193.

Runaway speed tests shall be made to determine the maximum runaway speeds under conditions corresponding to prototype net heads with range of 65% to 125% of rated net heads with the guide vane opening that produces the highest runaway speed.

Guide vane torque tests shall be conducted over the full range of outputs from no-load to full guide vane opening and at runaway speed. The maximum opening and closing torque on a guide vane out of synchronism with the other guide vane shall be determined for both on-load and runaway conditions.

The model test shall include but not be limited to the following tests:

i) Efficiency Tests

ii) Determination of peak efficiency of the model and estimation of peak efficiency of the prototype,

iii) Measurement of flow and hydraulic thrust at various openings and unit speeds corresponding to 65% to 125% of rated net head.

iv) Complete Hill chart,

v) Cavitation characteristic at various points corresponding to 65% to 125% of rated net head.

vi) Guide vane torque tests

vii) Verification of dimensions of various sections of spiral case, draft tube, guide vanes, Runner vanes etc.

viii) Runaway characteristics at various guide vane openings as per IEC.

ix) Any other standard test to be mutually agreed as per IEC.

The model test shall simulate all possible operating conditions of the prototype for the entire range of operation at unit speeds from 65% to 125% rated head.

2.4.6.4 Model test report

After completion of the model tests, the Contractor shall submit to the Employer six (6) hard copies and Soft copies of the model test reports for approval within one month. The test report shall include, but may not necessarily be limited to, the following:

1) A description of the close loop test facility, test equipment and test procedures used for model testing.

2) Sample calculations for all calculated parameters including efficiency, cavitation and run-away speed for the model and step-up for the prototype,

3) Comparison of test results with the guarantee requirements of specification/contract and technical conclusions,

4) Model test curves for:

i) Unit power, unit discharge, efficiency versus speed for various guide vane openings,

ii) Relation of power output, efficiency and discharge to cavitation coefficient-sigma for various guide vane openings and speeds corresponding to the head range to be encountered in service,

iii) Relation of runaway speed to guide vane opening at the 65% to 125% of the net head.

iv) Hill diagram as specified above.

5) Prototype turbine curves showing:

i) Relation of efficiency, turbine output and discharge with cavitation limits indicated,

ii) Relation of turbine discharge with guide vane opening for the head range of 65% to 125% of the net head.

iii) Relation of runaway speed to guide vane opening for the net heads of 65% to 125% of the net head.

6) Photographs of the runner showing appearance of cavitation during the cavitation tests,

7) Detailed dimensional drawing of the model turbine, including the runner, guide vanes, spiral case and draft tube used for the tests.

8) A sample calculation for each computation from data to final result,

9) Record of calibration of all test instruments and equipment.

2.4.6.5 Model acceptance

1) Within 60 (sixty) days following the receipt of the model test report, the Employer will communicate his decision of the model test to the Contractor. The Contractor shall commence the manufacture of the prototype only after the approval of the model has been accorded.

2) The final report shall be approved within twelve (12) months from the effective date of the Contract, subject to its submission at least sixty (60) days earlier.

3) Should the model fail to meet the requirement of guarantee and other requirements, the Contractor shall modify the same until it complies with the requirements. All expenses involved for the modification and subsequent model tests shall be borne by the Contractor.

2.4.7 Field acceptance tests

Capacity and efficiency tests shall be conducted on one turbine, chosen by Employer at a later date, to verify that the power output and efficiency guarantees have been fulfilled.

The power output and efficiency tests on the turbine shall be made at net effective head as near as practicable to the rated net head. The efficiency test shall be made by the thermodynamic method. The turbine capacity shall be determined from electrical measurements of generator output corrected for generator losses. The generator losses shall be determined from the generator efficiency curves and verified by measurement of air cooler and bearing heat losses.

The turbine efficiency and capacity tests shall be conducted in accordance with the provisions of IEC Publication 60041, International Code for Field Acceptance Tests of Hydraulic Turbines. The test shall be conducted under the direction of a qualified independent expert to be decided by the Employer, unless otherwise mutually agreed upon by the Contractor and the Employer. The costs will be borne by the Owner.

In addition to the field acceptance test, an Index test for flow measurement by acoustic method shall also be performed after calibration of both the equipment i.e. Winter Kennedy apparatus and acoustic flow (ultrasonic) measurement system in accordance with IEC.

i) To determine the performance characteristics as expressed by the relative values of power, discharge and efficiency.

ii) To conduct Index test to check the deterioration in performance of the machine with time.

2.5 Design and Construction

2.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

Sl. No.	Standards	Description
1.	IEC 60193	Hydraulic turbines, storage pumps and pump-turbines - Model acceptance tests.
2.	IEC 60609	Cavitation pitting evaluation in hydraulic turbines,

Sl. No.	Standards	Description
		storage pumps and pump turbines.
3.	IEC 60041	Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump- turbines.
4.	IEC 60545	Guide for commissioning, operation and maintenance of hydraulic turbines.

2.5.2 Design stress limits

Design stress limits shall be as per clause 1.5.1.1 “Maximum allowable stresses” of “Section 1 - General Technical Requirements”.

2.5.3 Material selection and standards

The material specifications and their standards for major components of Turbine shall be as shown below. The material grade and classification wherever specified are obligatory and proposed equivalent national/international standard for the same shall also be considered if their chemical composition, mechanical properties, manufacturing methods are similar/superior and are suitable for proposed use. The Contractor shall establish the equivalence/superiority for acceptance by the Employer.

S. No.	Item	Material	Material Standard
1.	Runner	Stainless Steel, 13Cr-4Ni	ASTM A 743 Grade CA6NM or ASTM A 240 UNS541500
2.	Runner Cone		
3.	Shaft seal sleeve/liner		
4.	Rotating labyrinth (Upper & Lower)	Forged Stainless Steel	ASTM A473 UNS S41500
5.	Fixed labyrinth (Upper & Lower)		
6.	Guide vanes	Stainless Steel, 13Cr-4Ni,	ASTM A 743 Grade CA6NM
7.	Facing plates	Stainless Steel, 13Cr-4Ni,	ASTM A240 UNS S41500
8.	Discharge ring	Stainless Steel, 13Cr-4Ni,	ASTM A240 UNS S41500
9.	Bottom Ring	Carbon Steel,	IS 2062 E350/ASTM A 516 Grade 70

10.	Head cover	Carbon Steel,	IS 2062 E350/ASTM A 516 Grade 70
11.	Draft tube cone	Carbon Steel,	IS 2062 E350/ASTM A 516 Grade 70
12.	Spiral case	Carbon Steel,	IS 2062 E350/ASTM A 516 Grade 70
13.	Stay ring & stay vane	Carbon Steel,	IS 2062 E350/ASTM A 516 Grade 70
14.	Draft tube	Carbon steel	IS 2062 E350/ASTM A 516 Grade 70
15.	Turbine shaft	Carbon Steel,	ASTM A 668 Class E
16.	Turbine guide bearing housing	Carbon Steel,	IS 2062 E350/ASTM A 516 Grade 70

2.5.4 Fixed/ embedded components

2.5.4.1 Spiral case

The spiral case shall be built up from carbon steel plate. The design shall be such that hydraulic losses are minimized.

The spiral case shall be supplied in suitable sections to suit the transport limitations. These shall be assembled and welded with stay ring. Complete assembly shall be hydrostatically tested at site. The Contractor shall supply all consumables including electrodes and necessary testing arrangements.

Spiral case shall be concreted as per the OEM standard practice by the Contractor. If required wool felt sheets of appropriate thickness (as approved during detailed engineering) shall be put around the spiral case, supply of which shall be in the scope of the Contractor. Spiral casing drain shall be connected to Draft tube. However, contractor may propose any other alternative method / technical conditions for concreting of the spiral casing as per their standard practice.

The spiral case shall be designed for minimum internal design pressure of 38 bars. Three (3) mm corrosion and abrasion allowance in the thickness of spiral casing shall be taken.

All lugs, jacks, foundation bolts, tie rods and turn buckles, bracing etc., necessary to facilitate assembly and prevent distortion during shipping, pressure testing and concreting shall be supplied by the Contractor.

A watertight casing manhole shall be provided. The clear manhole opening shall be 750 mm wide.

Piezometer & other necessary tapings shall be provided for the measurement of various parameters for Winter-Kennedy flow measurement, field test etc. The piezometer board shall be equipped with test fittings for ultrasound tests. All piezometer pipes and header shall be made of seamless stainless steel of minimum schedule 80. All piezometer pipes shall be made of seamless stainless steel. All the piezometric/ efficiency measurement/ pressure pipes connected to spiral casing/ stay

ring, if embedded, need to be ensured properly sleeved duly welded to the component at the point of take off and left outside the concrete strategically.

A drain outlet complete with heavy removable stainless steel grating, studs, nuts and cast steel body gate type drain valve with all necessary fittings should be provided for complete drainage of the spiral case through draft tube. During erection, Two sets of Suitable stairs for inspection of spiral casing shall also be provided, as shown in the figure (indicative)



2.5.4.2 Stay ring

Stay ring shall be of fabricated carbon steel plate or cast welded construction, heat treated before final machining to relieve locked up casting or fabrication stresses and sectionalised as necessary for handling and shipment. It shall consist of upper and lower rings, rigidly held together by stay vanes, which guide the water to the guide vanes.

For fabricated stay ring with shrouded plate design, the vanes shall protrude through the upper and lower rings and shall be welded with full penetration welds. For fabricated stay rings with parallel plate design, the stay vanes shall be welded to the flat plates with full penetration welds. The stay rings vanes shall be designed and shaped to direct the water flow with a minimum head loss and to eliminate vibrations.

Machined flanges shall be provided for bolted connections between the stay ring and head cover, between the stay ring and the bottom ring. The pit liner (s) shall be welded directly to the stay ring.

The surfaces of the stay ring and welded joints in contact with the water shall be ground to a smooth finish. Suitable number of holes not less than 150 mm in diameter shall be provided to facilitate the placing of concrete. Suitable provision shall be made for sealing of the holes after the concrete is placed. Adequate numbers of tapped holes, 20 mm in diameter, shall be provided for pressure grouting. After pressure grouting, plugs shall be installed and ground flush. Air-vent holes with sealing arrangement shall be provided through the webs in isolated pockets.

Gravity drain pipe of suitable size shall be provided in turbine pit to cater the leakages from shaft seal. Suitable connection should be furnished clear of the embedded parts for the continuation of these piping to the drainage gallery.

The stay ring shall be designed to transmit the required loads to the concrete based on the design of the generating unit.

A hydrostatic pressure test of the spiral case and stay ring shall be conducted before concreting for each unit at a hydrostatic pressure of 1.5 times maximum internal design pressure as per standards. Required quantity / numbers of testing arrangement i.e. test cylinder (s), bulks head(s), pump – motor set etc shall be provided by the contractor to meet the schedule.

2.5.4.3 Draft tube liner

The draft tube liner shall be fabricated from carbon steel plate and adequately ribbed and stiffened to prevent distortion. The top of the liner shall be machined true to level and diameter for bolting to the draft tube cone. The thickness of carbon steel plate shall not be less than 16mm in case runner discharge diameter is 3.5 m or more. If the runner discharge diameter is less than 3.5 m, the thickness of the Carbon steel plate shall not be less than 12mm.

Sufficient number of piezometer taps shall be furnished in the liner at draft tube outlet for efficiency tests. All piezometer pipes, pipe header and taps along with stainless steel piping for embedment in concrete shall be of seamless stainless steel minimum schedule 80. All the embedded piezometeric pipes shall be protected by passing the same through suitable larger diametric pipe. All the piezometric/ efficiency measurement/ pressure pipes connected to spiral casing, speed ring or discharge ring, if embedded, need to be ensured properly sleeved duly welded to the component at the point of take off and left outside the concrete strategically.

Provision shall be made in the draft tube liner for support of beams on which a repair and inspection platform may be erected.

Dewatering pipe connection on draft tube shall be provided at the 200mm above the lowest point of the elbow complete with necessary valves, to discharge unit water in to dewatering sump. The valves shall be operable from higher elevation to be decided during detail engineering. Air pipe connection shall be provided for cleaning of the valve / dewatering pipe. Dewatering pipe entry connection on draft tube shall be provided with heavy removable stainless steel grating, studs, nuts etc.. Walkways around the dewatering header in drainage gallery shall be provided with gratings or suitable openings to facilitate visual inspection of equipment located below the walkways.

The draft tube liner shall be completely assembled and match marked in the shop with all stiffeners, ribs etc. accurately fitted.

Sufficient number of levelling screws, jacks, anchors, turn buckles and hold-down bolts shall be provided to permit centring, levelling and securely holding the liner both vertically and laterally during assembly and while concrete is being placed.

Suitable number of holes not less than 150 mm in diameter shall be provided to facilitate the placing of concrete with provision of sealing the holes after concrete is placed. Adequate number of suitably spaced 20 mm diameter tapped grout holes covering each grid formed by ribs shall be provided to facilitate final low pressure grouting of the liner after shrinkage of the embedding concrete has taken place. Suitable plugs shall be installed for the grout holes and ground flush after grouting is completed.

Minimum Limit of supply of Draft Tube liner shall be tentatively 13700 mm (refer drawing no. NH/DEM/ URI I STG II /PH/01) from the unit centre line or up to the point where velocity is 4.0m/sec, whichever is higher.

2.5.4.4 Pit liner

Pit liners of heavy steel plate, with servomotor pockets, shall be provided. It shall be made in sections with welded connections as necessary for shipment. Pit liners shall be prepared for welding to the stay ring. The vertical pit liner plate wall shall not be less than 16mm thick.

The liner shall be adequately ribbed and substantially anchored to the surrounding concrete in order that forces may be transmitted from the structure above the casing through to the stay ring without appreciable distortion of the pit liner. Contractor shall provide additional pit liner anchors in the vicinity of the servomotor mounting to ensure adequate support.

The upper pit liner servomotor pockets shall be welded to the pit liner section. Flanged openings shall be provided for connection to the various piping inside the turbine pit. Height of the pit line shall be approximately upto turbine pit top cover/Generator bottom cover or as decided during detailed engineering.

A lower pit liner, in case of bottom removal of runner, of steel plate shall be provided for draft tube cone pit in sections with welded connection as necessary for shipment. The top of the liner shall be prepared for welding to the stay ring with full penetration. It shall extend up to the rooftop of the runner removal gallery access.

Adequate number of grout holes shall be provided as specified under clause 2.5.4.3.

2.5.5 Stationary/ removable components

2.5.5.1 Draft tube cone

Draft tube cone connecting discharge ring to draft tube shall be fabricated from carbon steel plate and suitably designed to provide ease of removal from the turbine pit/ runner removal gallery, for dismantling of runner from below.

Two (2) watertight and air tight diametrically opposite manhole doors, having a clear opening of at least 750X750 mm, shall be provided in the draft tube cone. The manhole doors shall have rounded corners, hinged to open outwards into the runner removal gallery. The hinges shall be of rugged design and provided with an adjustment to accurately align the door. The inside surface of the doors shall be contoured and ground flush

with the inside of the draft tube cone. Bolts and accessories of the doors shall be of stainless steel. A test cock, which provides a clear bore in the open position for rodding, shall be provided in the draft tube cone below one of the doors.

Suitable nos. of piezometer taps shall be furnished in the draft tube cone. The taps shall measure pressure at three points: two at the same level and 180 degrees apart, and the third at a different level but in the same vertical plane as one of the other taps. The piezometer taps shall be piped to the runner removal gallery and provided with isolating valves.

One pipe at minimum possible elevation connecting draft tube elbow & drainage channel/ gallery along with the valve shall be provided for stage dewatering of draft tube below the bolting elevation of draft tube plug. Air pipe connection shall be provided for cleaning of the valve / pipe.

2.5.5.2 Head cover

The Head cover shall be fabricated from carbon steel plate. It shall be of heavy construction, adequately ribbed and shaped so as to give rigid support to the turbine guide bearing, regulating ring, and the bearings for the upper stems of the guide vanes. It shall be bolted and doweled to a flange on the stay ring and also along radial joints where the head cover is sectionalized for handling and shipment.

All major stress carrying welds shall be fully penetrated and furnace stress relieved. Radial ribs of the head cover may be fillet welded. Balancing pipes preferably with valves shall be provided for releasing the pressure in the annular space between the runner crown and head cover. Material for balancing pipes & pressure relief pipe for labyrinth shall be seamless stainless steel of adequate size so that the pressure remains within the acceptable limits even with worn out labyrinths after long operations. The balancing pipe & pressure relief pipe for labyrinth shall be of schedule 80.

The head cover shall be designed to withstand safely and without detrimental deflection the maximum water pressure, bearing load and all other forces acting upon it.

The head cover assembly shall have machined seats for the turbine guide bearing, regulating ring, shaft seal, guide vanes and any other auxiliary equipment such as air vent, pipe connections etc. The head cover shall be so designed as to provide rigid support for the turbine guide bearing. A retaining ring or pads shall be furnished to prevent any lifting tendency of the regulating ring.

The guide seat for the regulating ring shall be provided with renewable bronze or self-Lubricating liners accurately machined so as to ensure minimum lost motion and friction in the operation of the regulating ring.

Self-lubricated Bush bearings and water cup seal arrangement for each upper guide vane stems as described in Clause 2.5.5.5 “Guide Vanes and Operating Mechanism” shall be provided in the head cover. Suitable drains shall be provided for any leakage water from the seals so that water cannot collect in the spaces between the ribs. The lower surface of the head cover shall be accurately machined to provide a smooth surface to the water passage at the entrance to the runner.

Replaceable 13Cr-4Ni stainless steel facing plates of minimum 30mm thickness in suitable sections shall be provided on the inner surface of the head cover and lower face of the head cover coming in contact with water. Design of facing plates shall be such that the replacement of the same shall be carried out without removal of Top Cover. Fixing arrangement of liner by suitable stainless steel bolts shall be done from non-water side so as not to be susceptible to silt erosion/damage and shall be easily accessible for maintenance. Bolts for holding the liner shall nor pierce the liner all through.

Provision should be made so that the installed runner can be moved upwards sufficiently to relieve the thrust bearing of the total rotating mass during maintenance and to remove the pads and arrangements without any damage/ rubbing.

A replaceable stainless steel labyrinth seal ring or rings, accurately machined to form a water seal with the runner crown and shaped to reduce leakage, shall be secured to the head cover. Any hydrostatic pressure build-up behind the labyrinth seal rings shall be relieved through built-in pressure relief holes. The labyrinth seal rings may be of the same composition as the sealing face on the runner provided it is at least 50 BHN lower in hardness. Leakage of water through the labyrinth seal will be directed to the draft tube without building pressure under the head cover.

Suitable number of pipe connections shall be provided in the head cover for provision of admission of compressed air for depressing tail water in the draft tube to operate the unit as a synchronous condenser. Another connection shall be provided for the provision of admission of make-up air during depressed tail water operation. Contractor shall provide isolating valves, check valves, and all necessary piping and fittings within the turbine pit. Leakage of water through the seals will be directed to the draft tube without building pressure under the head cover. Provision of cooling water to the runner seals to be used during operation of the unit with the tail water depressed shall be provided.

At least four inspection holes shall be provided in the head cover to permit inspection and check on clearances of upper labyrinth of the runner. The inspection holes shall have gasketted covers bolted to the head cover.

A minimum of three piezometer connections shall be provided on the head cover piped to a common manifold equipped with suitable valves and a pressure gauge. These connections shall be arranged so that radial variations of water pressure under the head cover can be measured. The pressure gauges shall be mounted on the turbine gauge panel outside the turbine pit.

Walkways around the head cover and turbine bearing shall be provided with gratings or suitable openings to facilitate visual inspection of equipment located below the walkways.

Adequate number of eyebolts and polyester rope slings shall be supplied to lift the head cover. Provision through suitable anchors shall be made in the turbine pit to raise the head cover. The head cover shall be designed to pass through the wound generator in one piece during erection and dismantling and with the runner and shaft in place. Suitable access shall

be provided in the head cover for maintenance of the shaft seal without removal of the head cover and to facilitate easy removal of shaft seal components.

Provision of minimum 300 mm diameter or more pipes connected to turbine pit at suitable elevation and the drainage gallery should be made to drain the top cover to avoid ingress of water into turbine guide bearing in any eventuality. This shall be in addition to the gravity drainage and other systems.

2.5.5.3 Bottom ring

The bottom ring shall be fabricated from carbon steel plate. The welds shall be fully penetrated and stress-relieved before final machining. The bottom ring shall be of heavy rugged construction and all necessary anchors and adjusting screws shall be provided. It shall be sectionalized as necessary for handling, shipment and removal.

Bottom ring shall be so designed that it shall be possible to remove the runner by dismantling the discharge ring only without disturbing the bottom ring and guide apparatus arrangement.

Self-lubricated bush bearings similar to those in the head cover shall be provided for the lower stems of the guide vanes. The bottom ring shall be designed to be adequately bolted and doweled to the stay ring and discharge ring.

Replaceable 13Cr-4Ni stainless steel facing plates of minimum 30mm thickness in suitable sections shall be provided on the inner surface of the bottom ring coming in contact with water and upper horizontal surface of the bottom ring. Fixing arrangement of liner by suitable stainless steel bolts of facing plate shall be done from non-water side so as not be susceptible to silt erosion/ damage and shall be easily accessible for maintenance. Bolts for holding the liner shall not pierce the liner all through.

2.5.5.4 Discharge ring

The discharge ring shall be fabricated from stainless steel plate, sectionalised as necessary to facilitate shipment and handling. The welds shall be fully penetrated and stress-relieved before final machining. It shall be of heavy section and adequately ribbed externally to prevent distortion.

A replaceable stainless steel labyrinth seal ring or rings, accurately machined to form a water seal with the runner band, shall be secured to either the discharge ring or bottom ring. The labyrinth seal ring shall be designed to minimize leakage. Any hydrostatic pressure build-up behind the labyrinth seal ring shall be relieved by the pressure relief holes. The labyrinth seal rings shall be of same composition as the sealing face of runner but 50BHN lower in hardness.

The discharge ring shall have a machined surface at the top for supporting the bottom ring. Flanges for bolted connection to the draft tube cone at bottom shall be provided. Necessary adjusting jacks with steel bearing plates shall be furnished to facilitate levelling during erection.

Suitable arrangement shall be provided to support the runner and shaft when disconnected from the generator.

At least four inspection holes shall be provided in the discharge ring/ bottom ring to permit inspection and check on clearances of the lower runner labyrinth seals. The inspection holes shall have gasketted covers bolted to the discharge ring.

2.5.5.5 Guide apparatus and regulating mechanism

A) Guide vanes and operating mechanism

The turbine shall be equipped with one set of cast stainless steel guide vanes with integral stems and trunnions. The guide vanes shall be uniform in shape, and their sections/profile shall be such as to direct properly and accelerate gradually the water entering the runner with a minimum of friction and hydraulic disturbance.

The number of guide vanes and the number of runner vanes shall be coordinated in a manner to ensure that the turbine will operate without objectionable vibrations.

The guide vane material shall be 13Cr-4Ni stainless steel. The guide vanes shall be accurately machined and ground to a smooth finish and even surface. The tips and contact surfaces shall be machined in such a fashion as to provide for uniform contact when in the closed position. All guide vanes shall be interchangeable. The final surface finish of the guide vanes shall be in accordance with relevant latest standards.

Each guide vane shall be provided with self-lubricated bearing in the head cover and bottom ring. Two self-lubricated bearings and water cup seals with stainless steel cover plate shall be provided for each of the upper guide vane stems in head cover. One self-lubricated bearing with water cup seals shall be provided for each lower guide vane stems in bottom ring. All bolts and nuts shall be of stainless steel. Design of self-lubricated bushes shall ensure their operation in high silt and their type/ makes etc. shall be finalised during detailed engineering with prior approval of the employer.

Each upper guide vane stem shall be provided with a self-lubricated thrust bearing for collar. Positive means shall be provided to permit the vertical clearance for the guide vanes to be adjusted from above the head cover. Wear washers are not acceptable.

Guide vane stems, links, and regulating rings shall be designed to produce a minimum of lost motion and friction. The guide vanes shall be connected through couplings, links and levers to the regulating ring. The link pins shall be of the eccentric type with at least 6 mm of eccentricity to facilitate adjustment. During tower assembly and before dowelling of the guide vanes items, the eccentric pins shall be set in such a way that all of the 6 mm of eccentricity is available for future adjustments. The design shall be such that repairs and replacements can be easily and quickly made with minimum dismantling of the turbine. The Contractor may propose any other proven design subject to approval of the Employer.

The guide vane regulating ring shall be made of cast steel or welded steel plate, with all welds fully penetrated and stress-relieved. The regulating ring and guide vane operating mechanism shall be so designed as to

remain undisturbed when dismantling and replacing the main guide bearing and accessories.

The guide vane operating mechanism shall be of ample strength to withstand the maximum load that can be imposed on it by the most severe operating conditions. All parts having contact in motion shall be provided with self-lubricated bushings.

The bush housing shall be made of cast steel or carbon steel plate. Manufacturer may, however, propose any other arrangement for bushes/ bush housing of guide vane which can be considered during detailed engineering, if found better resistant to silt.

The turbine and/or generating unit shall be designed to withstand the additional stresses resulting from operation of unit with three (3) adjacent wicket gates passage being in blocked condition. The contractor shall provide the calculation to substantiate the provision in design of the gates become blocked.

A suitable shear pin shall be provided between each guide vane stem and the regulating ring, and shall be strong enough to withstand the maximum operating forces, but which will break in the event of excessive forces acting in either the opening or closing direction and will protect the rest of the mechanism from damage in case one or more of the gates become blocked.

For detection of shear pin failure, suitable electrical system would be provided to actuate an alarm in the event of breakage of a shear pin or switches with normally closed contacts shall be provided on each wicket gate operating linkage to actuate an alarm in the event of breakage of a shear pin.

Feedback mechanism shall be proximity sensor type. The protection class for proximity switch and cables shall be IP 67. There shall not be any joint up to the Junction box. For indication/feedback all series connection shall be made in junction box. Necessary junction boxes shall be incorporated in scope. In case cable provided with proximity sensors are not of sufficient length to reach junction boxes, connection boxes shall be used with IP67 protection class.

Stops shall be provided on the head cover in front of individual guide vane lever to limit the angle of movement of the guide vane stem levers in case of breakage of the shear pin or link so that interference of the loose guide vane with operation of the other guide vanes or runner will be prevented. These stops shall have manual adjustment provision with which the motion of the turbine guide vanes in the opening and closing direction can be positively limited/ restricted.

As a precaution against damage when a guide vane is free to rotate due to breakage of a shear pin or link, the guide vane levers shall be restrained from excessive movement by means of a friction device located on the guide vane stem which provides a restraining force between the guide vane coupling and lever. The friction device shall be designed to resist independent movement of the guide vane for the maximum hydraulic torque at any guide vane position. The friction device mechanism on each guide vane shall be tested during erection to ensure performance as designed.

Any other proven arrangement in place of shear pin and shear pin failure detection shall be acceptable subject to approval of the Employer.

B) Servomotors

The turbine shall be provided with two oil operated double-acting hydraulic servomotors having a combined capacity sufficient to supply the maximum force necessary to operate and hold in closed condition the guide vanes under maximum head, at the minimum oil pressure.

The servomotor shall be rigidly supported from the reinforced pads in the pit liner and shall be capable of moving the guide vanes from a completely closed position to a full open position in one stroke, and vice versa. The servomotors shall be recessed into the pit liner so that the head cover can be removed with the servomotor and piping in place.

The servomotor cylinders shall be provided with flanges for connecting oil piping. Connections for pressure gauges shall be provided at each end of each cylinder. An air vent and a drain cock shall be provided on each servomotor for draining purposes. There shall be positive margin in the cylinder with respect to full stoke length or any other alternate arrangement either in piston or cylinder for avoiding seizing of Servomotor when fully opened for longer period.

The servomotor cylinder shall be designed and located so that the force for moving the turbine guide vanes shall be divided approximately equally between the two cylinders and shall be applied in substantially equal magnitude to opposite sides of the guide vanes regulating ring and tangentially to the ring.

Provision shall be made for field alignment of the servomotors, using levelling plates supplied by the Contractor. The servomotor flange shall be doweled in the field to its mounting flange.

A manual locking device of simple construction shall be provided at both the servomotors to permit locking the guide vanes in fully closed positions and capable of withstanding safely the full operating force of the servomotors. Electrical contact switches shall be provided to indicate guide vanes lock in the fully closed positions. An additional contact for unit start interlock shall be provided. All contacts shall be wired to terminal blocks in the turbine terminal box.

Servomotors shall be shop tested under a hydrostatic pressure not less than 150 percent of the maximum design pressure of the governor oil system.

2.5.6 Rotating parts, guide bearings and seals

2.5.6.1 Runner

The runner shall be made of 13Cr-4Ni stainless steel which shall be connected to the turbine shaft in accordance with ANSI/IEEE Std 810 “IEEE Standard Hydraulic turbine and generator integrally forged shaft coupling and shaft run out tolerances” or applicable standard. The coupling shall be proposed by manufacturer as per their manufacturing

standard meeting all guaranteed parameters and proving sufficiency by calculation. The coupling bolts shall be designed for tightening using hydraulic tensioner/ tightening device as applicable. Preferably Friction coupling arrangement shall be considered for Runner cum Turbine shaft coupling.

The contour of the runner blades shall be accurate and shall be machine finished so that the blade profile precisely conforms to the model design within the tolerance set out in IEC Publication 60193. However, in view of high anticipated silt concentration runner blade thickness at outlet edges shall be approx. 15-20% more than the optimum design and runner blade thickness at trailing edge shall not be less than 16 (sixteen) mm. The blades shall be evenly and symmetrically spaced. Before shipment, the Contractor shall measure the hydraulic surfaces with templates and submit proof that the finished runner contours and shape agree with the tested model and the design requirements.

The surface of the runner in contact with water shall be ground to a smooth finish and even surface, without any humps or hollows. The final surface finish of the water passages shall be in accordance with latest International standard/practice. Band and crown sealing surface shall be finished to suit the stationary head cover and bottom ring seals.

The runner shall be designed to safely withstand the stresses due to operation at runaway speed under conditions of maximum head with no load on the generator and any position of the guide vanes. Special attention shall be paid to reduce stress concentration at the fillet of the blade outlet edge with the band and crown. The runner shall be statically balanced in accordance with applicable standards for large rotating machinery.

The runner shall be designed to support its own mass and the mass of the turbine shaft (when disconnected from the generator), with the runner resting on the shoulder of the discharge ring.

Replaceable 13Cr-4Ni stainless steel labyrinth seals shall be fixed to the runner both at the top and bottom ends with the help of stainless steel fasteners to reduce the leakages.

Bolted arrangement for labyrinths is preferable; however, in case any labyrinth is fitted through shrinkage, at least two sets of full arrangement of heating with heating pads, tools, slings, levelling turnbuckles etc. need to be supplied.

2.5.6.2 Turbine shaft

A turbine shaft shall be supplied by the Contractor to couple the runner with generator rotor. The shaft shall be made of forged carbon steel properly heat-treated. It shall be provided with coupling flanges at top and bottom for connecting to the generator shaft, and to the runner respectively.

The shaft shall be hollow having a diameter of at least 150 mm throughout its entire length and shall have a general outside surface finish of approximately 3.2 micrometers Ra.

Suitable oil baffles and water deflectors shall be provided between the main guide bearing and the shaft seal.

Two bands shall be machined and marked on the shaft for use for verticality and alignment purposes. Additionally, one band immediately above the turbine guide bearing housing location, of at least 100 mm width line, shall be machined on the shaft for use of non-contact type vibration pickup. The bands shall be concentric with the shaft with high surface finish of 0.8μ Ra.

The shaft couplings shall be designed as per provision of ANSI/IEEE Std 810. The coupling bolts shall be designed for tightening using hydraulic tensioner/ tightening device.

The turbine shaft diameter shall be coordinated with the generator shaft diameter. The critical speed of the combined turbine and generator and generator rotating parts shall be calculated by the Contractor and first critical speed shall be at least 25% above the maximum runaway speed.

2.5.6.3 Turbine guide bearing

The turbine guide bearing for radial support of the turbine main shaft shall be of babbited oil lubricated shell/ segmented or pad type. It shall be as near as possible to the runner consistent with convenient access to the shaft water seal. The bearing arrangement shall permit axial movement of the shaft necessary for adjusting the thrust bearing and for uncoupling. The bearing shall prevent foreign matter from entering the bearing running surfaces. Bearing pad area shall preferably be not less than 60% of journal contact area.

The bearing housing shall be made of cast steel, or welded plate steel of heavy construction. The bearing shall be rigidly supported on the turbine head cover. Irrespective of the material used, the bearing shall be stress-relieved before final machining operation.

The design of the bearing and oil reservoir shall permit their inspection and adjustment or removal without disturbing the head cover or major dismantling of other parts of the turbine. The bearing design shall be such that no water shall enter the lubricating system via the shaft seal, and there shall be no appreciable loss of oil by leakage past the lower oil shedder or by overflow from any part of the oil system under any condition of normal operation, within the range of headwater and tail water elevation from speed-no-load to full load.

The babbitt lining on the guide bearing shell/segments shall be according to a grade suitable for the bearing and anchored tightly to the shell. The babbitt lining shall be accurately bored and shall be suitable for oil circulation. The Journal shall have a surface finish of minimum 0.8 micrometers Ra.

Suitable lifting eye bolts and backing-out studs shall be provided for use in removing and installing the bearing segments.

The bearing shall be capable of being operated continuously, without any damage to pads & without causing any detrimental effect on future operation of the machine under following conditions:

- Continuous at any speed up to 110 percent rated speed under normal operating condition.
- For at least (15) minutes at any speed up to 110 percent rated speed and maximum load, without cooling water supply.

- For fifteen (15) minutes at any speed up to maximum runaway speed, with cooling water supply.
- For two (2) minutes at runaway speed without cooling water supply.

The bearing system shall be designed to withstand the additional stresses resulting from operation of unit with three adjacent guide vanes passages being in blocked condition or in case of breakage of shear pin of one or more guide vane resulting in freeness of the guide vanes at any location / angle.

The lubricating oils system shall be designed so that the temperature of the bearing metal and bearing oil shall not exceed 70^0C and 65^0C respectively under continuous operation in any operating conditions. The lubricating oils system shall have sufficient capacity to supply the required amount of oil to the turbine guide bearing, and the oil reservoir shall have sufficient capacity to hold all the oil in the entire bearing system, and to provide cool oil to the bearing under conditions of loads. The bearing design shall prevent the leakage of oil down along the shaft and shall provide for returning oil from the bearing to the reservoir. Separate piping for filling and draining the bearing oil from reservoir shall be provided with quick release coupling.

If cooling of the lubricating oil is necessary, a heat exchanger of 90:10 cupro-nickel coils shall be provided and shall be completely immersed in the oil. All connections to the coils shall be made outside of the oil reservoir and arranged so that water from a leaky connection cannot drip into the bearing oil reservoir. The coils shall be arranged to permit removal without dismantling the bearing. The coils shall be free from leakage when tested in the shop under a pressure of 10.0 bars for a period of 1/2 hour. The arrangement shall be subject to Employer's approval at design stage. To regulate the quantity of water flow in the coils a suitable valve shall be provided in the discharge line of the heat exchanger.

The Contractor shall supply and install the following indicating and protection devices for the turbine guide bearing. All electrical contacts shall be wired to terminal locks in the turbine terminal box.

i) DTT in all pads, gas filled thermometer, two in case of shell and four or more equally spaced in case of more no. of segments/pads for bearing metal and one in bearing oil for bearing oil temperature indication shall be provided. The devices shall have two sets of separately adjustable contacts for alarm and tripping circuits.

ii) Resistance temperature detectors (RTD's) - one in each segment/ pad for bearing metal and two for bearing oil for bearing oil temperature indication and recording at a remote location. (The lead extension cables to the terminal box and 3-wire twisted cable shall be suitably shielded. Separate terminals shall be provided in the terminal box for terminating the shields of individual RTD lead extension cables.) At least two of the above RTD's shall be configured for rate of rise of temperature.

iii) One electromagnetic induction type flow-meter with two electrically separate low-flow alarm contacts and recording at remote location for the bearing cooling water supply, if cooling water is required.

iv) One direct visual indicator of the bearing oil level marked in litres along with high and low level and oil level relay along with adjustable high and low level alarm contacts for remote indication.

v) One oil-water contamination detector,

vi) Resistance temperature detectors (RTDs) to measure the temperature of the incoming and outgoing water from the turbine guide bearing coolers, if cooling water is required.

vii) Temperature indicator for local temperature measurement of the incoming and outgoing water from the turbine guide bearing coolers, if cooling water is required.

viii) Pressure gauges at inlet and outlet of the turbine guide bearing cooler with low pressure alarm contacts, if cooling water is required.

2.5.6.4 Shaft seals

The Contractor shall provide two (2) shaft seals, one as main working seal and another as maintenance seal. The turbine sealing proposed by the Contractor shall be of special design. The arrangement and design of these seals shall be such that they remain fail proof even while the turbine is operating in water having high silt concentration and the maximum leakage shall be guaranteed by the Contractor. The seal shall be, water lubricated, hydro dynamically balanced and automatic self adjusting type. The seal should able to sustain at least 15000 hours of operation even, if the machine is operated upto 5000 ppm of silt concentration during the monsoon. Material for contacting seal rings shall be tough and wear resistant preferably PU or superior.

All components shall be hydraulically designed to meet the maximum and minimum pressure conditions required by the application. Design of Shaft seal housing shall be designed & fabricated of lightweight material in minimum four segments for ease in dismantling and assembly. However, the arrangement defined shall be as accepted by the Employer at the time of award of contract/ detailed engineering.

Arrangement of main working seal shall be such that it prevents any water entry into the bearing through the leakage along the shaft. The shaft seal shall be arranged for water lubrication. Two or more connections for water shall be provided, evenly spaced on the periphery to admit supply of clean water at a pressure sufficient to exclude foreign matter from the seal. Any leakage water from the seal shall be removed by drains. The seal shall be so arranged that it may be serviced without disturbing the bearing or dewatering the draft tube.

A maintenance seal shall be provided below the main working seal to allow the main seal segments to be serviced without dewatering the spiral casing. This maintenance seal shall prevent leakage along the shaft when the turbine is stationary.

Water for shaft sealing shall be drawn from the respective draft tube/ tail pool by pumps and shall be suitably cleaned and filtered before supplying to the shaft seal at a suitable pressure as per Schematic flow diagram no. NH/DEM/ URI I STG II /CW/01. Additionally shaft seal shall also be fed with clean water from fire fighting header.

Suitable lifting eye bolts and backing-out studs shall be provided for use in removing and installing the shaft seal parts.

The Contractor shall provide the necessary piping and the valves, including pressure reducing valves, filters, piping and fittings within the turbine pit, terminated by unions or flanges at a point outside the turbine pit.

All bolts, nuts, screws and hardware used in connection with the shaft water seal shall be of stainless steel.

The Contractor shall supply and install the following indicating and protection devices for the shaft seal for local and remote monitoring at DCS level. All electrical contacts shall be wired to terminal locks in the turbine terminal box.

i) An electromagnetic induction type water flow meter with adjustable alarm contacts shall be provided in the water supply piping to the seal for local and remote indication. Additional contact shall be provided to operate an indication light in the gauge panel to indicate that shaft seal water is “ON”.

ii) Wear indicator and position switch to enable local and remote monitoring/ indications of seal face wears.

iii) Pressure gauge and pressure transmitter shall be provided to indicate the difference in pressure between water supply line and beneath the shaft seal.

iv) Pressure gauge and pressure transmitter shall be provided to indicate the water pressure in the water supply line for local and remote monitoring respectively.

v) Temperature indicator and temperature transmitter shall be provided for local indication and remote measuring of water temperature below shaft seal.

vi) Pressure gauge and pressure switch shall be provided to indicate the air pressure of maintenance seal and seal engage indication.

2.5.7 Auxiliary systems and miscellaneous components

2.5.7.1 Turbine pit drainage

Turbine pit shall be designed in such a way that in case of flooding, the accumulated water is drained through gravity drain to prevent flooding of the turbine guide bearing.

For normal operation, one main and one standby AC motor driven submersible pumps with level switches for pumps automatic controls and lead-lag selectors shall be provided to drain head cover water leakage.

All the above pumps will be regulated/ operated depending on the water level sensed by float type level switches. Indications such as pump start/stop, pump-motor in electrical/ mechanical fault, high level alarm and low level alarm shall be provided.

2.5.7.2 Air admission system

An automatic air admission valve of suitable size, which shall be decided during detailed engineering, shall be provided for admission of air through openings through the generator/turbine shaft to the runner cone, to permit smooth operation of the unit throughout its operating range and especially during part load operations.

An air head shall be provided by the Contractor on top of the generator rotor to prevent tail water from entering the air vent piping. The air head shall be connected to air vent piping. The design of the air head and piping should be coordinated with the generator design. The design of the air head shall be such that the same can be inspected and maintained without disturbing the generator assembly.

The provision of secondary injection of air below the runner through discharge ring or draft tube cone at appropriate elevation should be made for possible injection of compressed air during part load condition, if required.

2.5.7.3 Walkways, access platforms, hatch cover, floor grating and stairs

Walkway, platform, staircases, hand rails etc shall be provided in the turbine pit to provide convenient and safe access to all operating equipment and points of lubrication. Also chequered plate/ grating covers shall be provided for runner removal hatch, equipment handling hatches and cables, cable trays, pipes or any other trench/ opening required for completing the floors around and over the works supplied under the contract.

The design of the gratings, stairs and handrails shall be in accordance to clause no. 4.11.2 of Section 4 of “General Technical Specification (GTS)” and shall facilitate easy removal to permit free access to turbine components. Suitable platform along with railing and stairs etc. shall also be provided at turbine- generator coupling level for ease of maintenance. The material for all handrails shall be stainless steel. The platform around the shaft shall be designed to support the weight of turbine guide bearing.

2.5.7.4 Turbine pit hoist

Each turbine pit shall be equipped with the necessary lugs and circular monorails having two nos. cross beams and two hoists covering the entire pit from turbine guide bearing housing to PCD of wicket gate to facilitate easy replacement of all equipment.

2.5.7.5 Access door to turbine pit

The turbine shall be provided with a metal acoustic access door(s) to be installed in the turbine pit concrete wall by providing frame on it. The doors shall have suitable handles and inside panic release bars. Each door shall have peeping window of thick toughened glass.

2.5.7.6 Acoustic barrier for runner removal gallery

The general area at MIV floor shall be acoustically isolated from runner removal gallery by providing acoustic shutter.

The Acoustic barrier with entrance door shall be removable type so that same can be removed during runner removal.

The leaves shall be made of lightweight acoustic material and shall be corrosion, water and vermin proof. The lowest leaf shall have a door for routine inspection and arrangement shall have an aesthetic look.

2.5.7.7 Tail water Depression system

The generator may be used, occasionally, in synchronous condensing mode. Bidder shall provide for rapid and sustained depression of water below the top of the draft tube liner by compressed air for synchronous condenser mode operation in accordance of the details under clause 2.5.5.2.

2.5.7.8 Nameplate

A rating nameplate of stainless steel shall be attached to each major and auxiliary item of equipment supplied. This plate shall be permanently engraved with the designed full load ratings, serial number, type number, date of manufacture and other identification deemed necessary. Hydraulic and electric control system diagram plates shall also be supplied. The identifying inscription shall be approved by the Employer.

2.5.8 Control and monitoring

The turbine and associated accessories/equipment shall be controlled and monitored at three levels:

i) By respective local control cubicles,

ii) By respective Unit Control Boards,

iii) By control and monitoring (SCADA) system through Unit Control Boards.

The details of control and monitoring requirement are defined in “Section 14 - Control and Monitoring System” and “Section 15 - Protection System”.

The Contractor shall make provision of contacts and/or ports in local control cubicles for interfacing with SCADA system for control and monitoring.

Local control shall be performed in an independent and standalone manner, and all information (faults, alarms, measurement, status) necessary for such control shall be displayed locally.

If the system consists of redundant subsystems, the priority of operation of such subsystems shall be selectable either from SCADA system or locally.

2.5.8.1 Instrumentation

The Contractor shall include suitable instruments, gauges, switches, contacts for achieving desired control and monitoring as defined in "Sections 14 - Control and Monitoring System" and "Section 15 - Protection System".

Contractor shall install all pressure and temperature gauges from turbine pit on a gauge panel installed outside the turbine pit. The pressure and temperature gauge pipes shall be brought from turbine pit to outside through an opening and properly protected by pipe sleeve. The panel shall be made of stainless steel. Single line drawing of the pressure gauges shall be affixed/ engraved on the panel. Pressure gauges shall be mounted in cut-out on front panel. Gauges nomenclature shall be marked for their easy identification. Colour of panel/equipment shall be as per GTR clause 1.5.2.

List of instruments to be furnished per unit with their location is given in Table below. However, the list is indicative only and scope/type shall be as per approved drawings/bill of materials during detail engineering.

S.No.	DESCRIPTION	TYPE OF INSTRUMENT	QUANTITY
1.	**Penstock**		
a.	Turbine Discharge	Ultrasonic and winter Kennedy flow measurement	1
2.	**Turbine water path**		
a.	Head cover pressure	Indicating Pressure Gauge and pressure transducer	1
b.	Runner downstream pressure (draft tube cone)	Indicating Pressure Gauge	1
c.	Draft tube exit pressure	Compound Gauge	1
d.	Shear pin for guide vane Normal / Break	Electrical system/ switch	As per approved scheme
3.	**Turbine bearing**		
a.	Turbine bearing metal temperature	Dial type thermometer with adjustable contacts	One in each shell segment/ pads
b.	Turbine bearing metal temperature	Resistance temperature Detector	1 in each shell segment / pad

c.	Turbine bearing oil temperature	Dial type thermometer with adjustable contacts	1
d.	Turbine bearing oil temperature	Resistance temperature detector	2
e.	Turbine bearing oil level relay	Indicating gauge with high and low level contacts and remote indication	1
f.	Capacitive type oil level controller	Indication for high and low level	1
g.	Turbine bearing cooling water flow, if applicable	Electromagnetic type flow meter with low flow alarm contacts for local and remote	1
h	Turbine bearing cooling water pressure at inlet and outlet, if applicable	Indicating pressure gauge at inlet and outlet and pressure transducer at outlet	2 gauges and 1 pressure transducer
i	Turbine bearing cooling water temperature at inlet and outlet, if applicable	Indicating thermometer and resistance temperature detector	2 nos. each at inlet and outlet
j	Water in oil detector	Moisture detector with alarm and indication	1
4.	**Guide Apparatus**		
a.	Guide vane position indicator	LVDT mounted on servomotor with contacts	1
b.	Servomotor mechanical locked position detector	Position indicator mounted on each servomotor with contacts	1
5.	**Turbine shaft seal system**		
a.	Shaft seal flow and low flow alarm	Electromagnetic type flow meter with low flow alarm contacts and remote indication	1
b.	Shaft Seal water pressure in water supply line and beneath the seal	Indicating differential pressure gauge	1

c.	Shaft seal water pressure in the water supply line and low pressure alarm	Indicating pressure gauge with contacts & Pressure transducer	1
d.	Water temperature below shaft seal	Temperature indicator and resistance temperature detector	1
e.	Shaft maintenance seal	Indicating pressure gauge & Pressure switch	1

2.5.8.2 Winter Kennedy method

Each turbine shall be provided with Winter Kennedy apparatus in the spiral case for continuous on-line monitoring of flow through the turbine. The required apparatus shall be installed permanently in the water passage for each unit. The equipment shall be as per IEC 60041-1991.

The flow meter system supplied shall include all the equipment and interconnecting wiring required to measure the flow rate for display and printing the measured values.

2.5.8.3 Vibration monitoring system

Vibration monitoring system has been defined in section 5 “Generator”. The Contractor shall make provisions for mounting of probes/transducers at desired location defined below:

i) Two (2) nos. non-contact type proximity probes at turbine guide bearing to measure radial vibration in both axes,

ii) Two (2) nos. contact type probes at turbine guide bearing housing to measure bracket/housing vibration,

iii) Synchronization probe.

2.5.8.4 Over speed device

The Contractor shall furnish a centrifugal type over speed device with provisions for electrical and mechanical tripping, on the shaft of each turbine above the guide bearing. The mechanical tripping device will directly actuate the governor shutdown valve though a hydraulic connection, in case of turbine speed exceeding preset limit. It shall be furnished complete with rotating and stationary trip mechanism, guards, connection to inlet valve control, and necessary supports. The mechanism shall be completely mechanical or oil-hydraulic and not dependent on electrical equipment for its operation. However, two electrical independent ungrounded changeover contacts shall be provided for alarm and initiating governor shutdown.

2.5.8.5 Silt measuring instruments

The Contractor shall furnish optical on line silt measuring instruments to indicate and record the silt content of the water passing through the draft

tube. The silt measuring instruments shall be capable of measuring instantaneous silt content in parts per million (ppm) by volume, with error not to exceed +/- 5 %. Output shall be indicated on digital indicator, with serial output for SCADA system.

The Contractor shall also furnish portable silt measuring instrument suitable for sedimentation measurement upto 8000 mg/L (minimum) with sedimentation range from 2.5 to 500 microns. Instrument shall be based on small angle laser scattering principle and compliant with ISO-13320-1.The instrument enclosure shall be RFI/EMI protected. It shall have feature for PC connection and analysis

2.5.8.6 Ultrasonic flow measurement system

Each turbine shall be provided with an ultrasonic flow measurement system in the penstock or spiral case extension, for continuous on-line monitoring of flow through the turbine. The required ultrasonic transducers shall be permanently installed in the water passage for each unit. The equipment shall be as per IEC 60041. The flow metering system shall drive data from four (4) sets (8 sensors) of transducers paths or more, to achieve the accuracy +/-0.5%.

The flow meter system supplied shall include all the equipment and interconnecting wiring required to measure the flow rate and net head for display.

2.5.9 Hard Coating

As the project is situated in Himalayan region due to which underwater parts of the turbine might get eroded on account of high silt laden water as per the informative PTS clause no. 2.2.3.5. It would be better, if the coating is repairable. It is envisaged to have suitable HP-HVOF hard coating on the underwater surfaces on the areas as per below:

i) Wicket Gate

a) Lower trunnion complete

b) Upper trunnion- at least 200mm above the guide vane collar

c) Top & bottom mating surfaces with top cover and bottom ring liner

d) Feather portion complete

ii) Runner and moving labyrinths

a) Top (crown inlet) and bottom (band inlet) peripheral surfaces

b) Pressure and suction side of the blade in complete height and min 300 mm length from leading edge & trailing edge

c) Min 300mm length between the blades at crown (inlet & outlet) and skirt/band (inlet & outlet) in water passage.

d) Top, Inner and Outer surfaces of moving labyrinth seal (upper) exposed to the water and 50 mm in the vicinity of labyrinth

e) Top, Inner and Outer surfaces of moving labyrinth seal (lower) exposed to the water and 50 mm in the vicinity of labyrinth.

f) Any other area, to be suggested by the manufacturer.

iii) Top Cover

a) Surfaces of fixed labyrinth seal (upper) exposed to the water.

b) Area of the facing plates exposed to the water

c) Any other area, to be suggested by the manufacturer.

iv) Bottom Ring

a) Surfaces of fixed labyrinth seal (lower) exposed to the water.

b) Area of the facing plates exposed to the water

c) Any other area, to be suggested by the manufacturer.

The hard coating is envisaged on the specific areas of the underwater parts of the turbine. The bidder shall submit complete technical detail of the coating, process of coating, proven performance, the agency where from the coating process is envisaged, the coating thickness, chemical composition and other maintenance aspects of the items which have been coated. It would be better, if the coating is repairable.

Further details in regard to the facility/possibility of carrying out such coating at site shall also be submitted. In case of otherwise in respect of any component due to its weight or size or any other constraints, the details in respect of the same shall also be submitted.

Thickness of the hard coating is envisaged to be 250 to 300 micron. Other parameter to be achieved on coated components shall be:

- Hardness of the coating – 1100 HV or higher
- Smoothness - 6 Ra or better
- Porosity - less than 1%
- Bond Strength - 10000 psi or better
- Particle velocity- 700 m/sec or higher

2.6 Drawings, Documents and Design Calculations

2.6.1 Design memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1- General Technical Requirements.”

2.6.2 Drawings and documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 - Technical Documents” of “General Technical Specification (GTS)”.

2.6.3 Design calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance.

i) Stress analysis of stay ring, spiral case, head cover, bottom ring, discharge ring, bearing, draft tube elbow and draft tube cone.

ii) Stress analysis of runner, turbine shaft and coupling bolts,

iii) Critical speed and bearing arrangement,

iv) Hydraulic transient analysis during load acceptance and load rejection including speed and pressure rise,

v) Draft tube elbow and draft tube cone surge frequency,

vi) Natural frequency of the unit,

vii) Heat exchanger / temperature rise calculation for turbine guide bearing.

viii) Calculation of foundation loads under various normal and most abnormal operating conditions for turbine components.

ix) Calculation for deciding capacity for Blowdown air compressed air system for synchronous condenser mode operation.

2.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements."

2.8 Spare Parts

Recommended spare parts shall be supplied in accordance to clause 1.8 "Spare Parts" of "Section 1 - General Technical Requirements". Specified spare parts to be supplied under this section are as follows:

S. No.	Description	Quantity
1	Coated Runner complete with moving coated labyrinth seals complete with fixing bolts, as per applicability, runner cone and fixing bolts	1 no.
2	Set of coupling bolts and keys(if applicable) runner to turbine shaft	1 set
3	Coupling bolts turbine shaft to generator shaft	1 set
4	Coated Labyrinth seals Upper including fasteners Fixed labyrinth seals Moving labyrinth seals	2 sets 2 sets
5	Coated Labyrinth seals Lower including fasteners Fixed labyrinth seals Moving labyrinth seals	2 sets 2 sets

S. No.	Description	Quantity
6	Coated Liner/facing plates for top cover including fasteners	2 sets
7	Coated Liner/ facing plates for bottom ring including fasteners	2 sets
8	Complete set of coated guide vanes (fully machined)	1 sets+ 1no.(Uncoated guide vane)
9	Maintenance seal with accessories	2 sets
10	Set of Shaft seal stationary & rotating seal ring with fasteners	2 nos.
11	Turbine guide bearing segments/ pads complete set	1 set+1 no.
12	Guide apparatus	
12.1	Bushes for top, middle and bottom stems of guide vanes	1 sets each
12.2	Guide vane servomotors LH and RH	1 no. each
12.3	Shear pins	1 sets
12.4	Bushes for regulating mechanism	1 sets
12.5	Key laid / Key driven, if applicable or relevant part	1 sets each
12.6	Bearing strips of each type for regular mechanism	1 set
13	Set of turbine head cover water level detector	1 nos.
14	Turbine head cover pump-motor (Submersible)	1 nos.
15	DTT (Dial Type Temp. Thermometer) / thermometer of each type	5 nos.
16	RTD (Resistance Temperature Detector) of each type	5 nos.
17	Water flow meter / switch of each type	1 nos.
18	Pressure gauges of each type	1 nos.
19	Pressure switch / pressure transmitter of each type	1 nos.
20	Oil level gauges of each type	1 nos.
21	Valves of size 80 mm and above including spiral drain valve	1 no. of each used type
22	All seals (cup seal, rubber cord, 0-Rings, packing, gaskets etc. complete set of servomotor seal kit with bush)	1 set

S. No.	Description	Quantity
23	Hydraulic Over speed Device	1 set

One set defines total quantity used in one turbine.

The contractor shall furnish the list of recommended spares in accordance to clause 1.8 “Spare Parts” of “Section 1 - General Technical Requirements”.

2.8.1.1 Optional spares

In view of the high silt, more number of spares of underwater parts may be decided by the employer. It is as such mandatory to mention item wise prices of below mentioned spares in the BOQ. The quoted prices shall be applicable for 5 years from the award of Contract. However, decision for procuring below mentioned spares and the quantity shall be optional for the employer.

S.No.	Description	Quantity
1.	Coated Runner complete with moving labyrinth seals complete with fixing bolts, as per applicability, runner cone and fixing bolts.	1 no.
2.	Coated Labyrinth seals Upper including fasteners Fixed labyrinth seals Moving labyrinth seals	 1 set 1 set
3.	Coated Labyrinth seals Lower including fasteners Fixed labyrinth seals Moving labyrinth seals	 1 set 1 set
4.	Liner/facing plates for top cover including fasteners	1 set
5.	Liner/ facing plates for bottom ring including fasteners	1 set
6.	Complete set of guide vanes	1 set
7.	Bushes for top, middle and bottom stems of guide vanes	1 sets each

One set defines total quantity used in one turbine.

2.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 “Tools and Instruments” of “Section 1 - General Technical Requirements”.

2.9.1 Special tools

The Contractor shall list and supply all special tools. List of such tools including their make and detailed specification, shall be submitted for acceptance by the Employer. The proposed list of special tools must include the following in addition to tools recommended by manufacturer(s);

i) Two (2) sets of Alloy steel socket wrenches of size M20 to M140 or higher if used along with reversible ratchet and extensions mounted on a stainless steel wrench board or in a stainless steel tool cabinet,

ii) Two (2) sets each of Alloy steel double open Jaw spanners of sizes M6 to M30 used mounted on a stainless steel board or in a stainless steel tool cabinet,

iii) Two (2) sets of Alloy steel sledge type/ slogging single ended open Jaw spanners of sizes M20 to M140 or higher if used mounted on a stainless steel board or in a stainless steel tool cabinet

iv) Two (2) sets each of Alloy steel combination ring and open end spanner of size M6 to M30 mounted on a stainless steel board or stainless steel tool cabinet,

v) Two (2) sets of Alloy steel ring spanner of size M20 to M140 or higher if used mounted on a stainless steel board or stainless steel tool cabinet,

vi) Two (2) sets of Torque wrenches with drive sizes and adjustable torque setting covering torque range up to 1000 N.m or higher if required.

vii) Two (2) sets of Torque multipliers with suitable input and output drive sizes with adjustable torque setting for covering torque range up to 3000 N.m. or higher if required.

viii) Two (2) sets of electric impact reversible wrenches of suitable drive sizes covering torque range up to 1000 N.m.

ix) One (1) set of hydraulic bolt tensioners with two identical tensioners operated by a common power pack for runner/ turbine shaft flange coupling bolts, as per applicability

x) One (1) set of hydraulic torque tensioners with two identical tensioners operated by a common power pack for turbine shaft/ generator flange coupling bolts

xi) One (1) set of hydraulic wrenches with power pack for each type of bolt size viz. head cover, bottom ring, runner cone bolts, labyrinths, draft tube cone bolts etc. used in the plant.

xii) One (1) set of Stainless steel runner blades templates.

xiii) One (1) set of Stainless steel guide vanes templates,

xiv) One (1) set of Stainless steel facing plate template,

xv) One (1) set of Stainless steel stay vane template,

xvi) One (1) sets of removal/assembly arrangement devices and tools for turbine guide bearings,

xvii) One(1) set of different size of Polyester Sling - round, for handling head cover, bottom ring, draft tube cone, guide vane, shaft, runner, servomotor, TGB and other turbine components

xviii) One(1) set of Steel wire slings- Flat, for handling head cover, bottom ring, draft tube cone, guide vane , shaft, runner, servomotor, TGB and other turbine components

xix) Four (4) no. of Eye Bolts of each size (M10, M20, M24, M30, M36, M42, M48, M50, M56) for handling of turbine components

xx) Four (4) no. of D- shackles of each size 1T, 2T, 5T 10T, 20T, 25T, 50T for handling of the turbine components.

xxi) Two (2) sets of Hydraulic jack of capacity 2T, 5T 10T, 20T, 25T, & 50T for required for erection and maintenance.

xxii) One(1) set of Hydraulic hollow jacks of capacity 5T, 10T for required for erection and maintenance.

xxiii) One(1) set of screw jacks of capacity 5T, 10T for required for erection and maintenance.

xxiv) One (1) set of portable digital industrial heavy duty crane hanging weighing machine for runner weight measurement.

xxv) Two (2) set of HSS & carbide Tap sets for Internal threading along with handle for all size threads used in turbine components (taper or straight as per site requirement) upto M48 or below.

xxvi) Two (2) set of HSS & carbide Drill bits along with Reamers (taper or straight as per site requirement) & handle for preparation of dowel hole upto 48mm or below used in turbine components.

xxvii) Two (2) sets of heavy-duty industrial pneumatic wrench of suitable drive sizes with heavy duty impact socket sizes (10 nos of each size) suitable for draft tube cone, Bottom Ring, Top Cover, Bearing Housing etc for bolting along with all associated accessories. Sockets provided shall be suitable for fitment in requisite components as mentioned above. However, the other attachment e.g. pipes & fittings, instrumentations, valves, safety devices etc shall be fitted in runner removal pits & turbine pits at convenient locations (not obstructing the any path)

2.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements specified separately in “Quality assurance and Testing Specifications (QTS)”.

4 MAIN INLET VALVE AND ACCESSORIES

4.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Employer's personnel, handing over to NHPC and guarantee for two years of Two (2) sets of main inlet valves, as per the specifications hereunder, each complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

4.1.1 Spherical valve and associated components

1) Two (2) sets of 2.8 m diameter turbine main inlet valves of the Spherical type assembly complete in all respect comprising of valve bodies, rotor, trunnions and counter weights, together with bearings, service seal, maintenance seal and appurtenances.
2) Two (2) sets of embedded and foundation parts.
3) Two (2) sets of hydraulic operating mechanisms each consisting of two double acting servomotors, including cylinders and necessary mechanical linkages.
4) Two (2) sets of by-pass assemblies with, piping, hydraulically operated valve, guard valve, isolating gate valve and control equipment.
5) Two (2) sets of automatic air release and air admit valves on the downstream side of the Spherical valve.
6) Two (2) sets of upstream extension pieces with penstock drain arrangement.
7) Two (2) sets of downstream extension pieces,
8) Two (2) sets of oil pumping unit consisting of following main components:
   i) All associated valves such as distributing, control, emergency shutdown, check valves including other types, piping, fittings etc.,
   ii) Dual oil filters with changeover facility along with clogging indication,
   iii) Oil sump tank,
   iv) Motor driven main and standby oil pumps mounted on the sump tank,
   v) Oil piston accumulator with associated accessories,

vi) Instrumentation such as pressure gauges, pressure switches, pressure transducer, moisture indicator, temperature gauges, temperature switches, level transducer, level gauges, level switch etc. required for the system,

vii) Other required accessories,

9) Two (2) sets of control systems including console, electro-hydraulic control, sensing and indicating devices, control piping, and devices for local and remote indication.

10) Two (2) sets of oil leakage unit, if required

11) Two (2) sets of nitrogen based oil pressurisation units along with required numbers of nitrogen bottles.

12) Two (2) sets of Nitrogen charging kits

13) Two (2) sets of access platforms complete with stairs and guard-rails for access to the manually operated bypass guard valve, isolating valve, drain valve, locking devices including stairs & steel platforms from MIV floor to the top of the main valve, air release & admit valve etc.,

14) Oil for first filling of all components with 10% extra quantity, in non-returnable drums, for all Two (2) units,

15) Two (2) sets of hydraulic tensioners complete with power pack, fitting, valves and special handling devices & fixtures for inlet valve components.

16) Provision of necessary contacts and/or ports for integration with plant SCADA system.

17) Spare parts in accordance to clause 4.8 “Spare Parts” of this section.

18) Tools and instruments in accordance to clause 4.9 “Tools and Instruments” of this section

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

4.2 Specific Parameters and Layout Conditions

4.2.1 Layout and general arrangement

Each main inlet valve, located at MIV floor, shall be of Spherical type complete with separate OPU system located at MIV/turbine floor. The OPU system shall be nitrogen and oil pressure operated.

The valve shall be used to connect and shut-off penstock during normal unit start-up, shut-down respectively and to permit unwatering of the turbines. The valves shall also be used to shut-off turbine flows in case of governor failure. The design of the valve shall be such as to resist the hydraulic forces acting directly on the body and rotor under all possible

conditions. When fully open, the valve shall provide minimum obstruction to flow of water.

The main inlet valves shall be handled by the Power house EOT crane of 150MT capacity. The contractor shall coordinate with the EOT crane manufacturer for hook approaches and handling by the crane.

4.2.2 Operating conditions

Depending upon operating requirements, the valve shall be either fully open or fully closed and no partial opening of the valve is envisaged. The normal opening and closing of the main inlet valve shall be by hydraulically operated double acting servomotors. Provision shall also be made to close the main inlet valve by counter weight only in the worst possible condition.

The valve shall be capable of closing against maximum head, including water hammer for maximum turbine discharge at all operating conditions including runaway with normal working stress on all parts.

4.2.3 Design considerations

4.2.3.1 Special Design conditions

The main inlet valve and its operating mechanism, extensions, couplings, bypass valve assembly, piping, sealing and drain system shall withstand safely the maximum stresses from the following operating conditions, with stresses in the materials not exceeding the maximum allowable stress as per clause 1.5.1.1 “Maximum Allowable Stresses” of “Section 1 - General Technical Requirements”:

i) Valve in open or close position withstanding the total maximum water pressure of 38 bars, which includes the pressure rise allowance.

ii) Opening of the valve at 50% unbalance and closing at 100% unbalance condition.

iii) By-pass valve assembly shall be designed for closure against maximum possible flow rate under maximum gross head. And also be designed to open under 100% unbalance condition.

iv) The MIV OPU oil shall be of same specification as the governor oil.

An over thickness of 3.0 mm shall be considered for all the parts such as valve body, trunnions, rotor and extension pieces in contact with the water, for corrosion and abrasion allowance.

The Contractor shall ensure that the counter weight closing mechanism shall not result in extra dimensioning of the power house.

4.2.3.2 Silt erosion consideration and petrographic analysis

The project is situated in Himalayan region where the silt content during high flow period is excessive and peaks abnormally during high flood. Even though material specifications have been included and it is not the intention to ask guarantee yet it is mentioned that the MIV and associated components are expected to operate under silt concentration (detailed enclosed in Enclosure-1) during high flood. The petrographic analysis of silt in water and chemical analysis of water is detailed in "Section 1, Enclosure – 1".

The Contractor shall critically study the silt data and chemical analysis of water and take the same into account in designing the main inlet valve and auxiliary equipment susceptible to abrasive effect of silt and making all such specific provisions so as to minimise the effect of silt.

4.3 Rating and Functional Characteristics

1	Number of valves	2
2	Type	Spherical
3	Nominal diameter	2.8 m
4	Penstock diameter at MIV upstream	3.25 m
5	Elevation of valve centre line	1228.7 m
6	Rated head	227.0 m
7	Design flow per unit	58.58 m3/sec at 227.0 m head
8	Design water pressure including water hammer	38 bars

4.4 Performance Guarantee

The main inlet valve along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system. The main inlet valve along with upstream extension piece and downstream extension piece shall be tested at 1.5 times the design pressure.

4.5 Design and Construction

4.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they shall be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S.No.	Standard	Description
1.	IS7332	Spherical valves for hydropower stations & Systems

4.5.2 Design stress limits

The design stress limit shall be as per clause 1.5.1.1 “Maximum Allowable Stresses” of “Section 1 - General Technical Requirements”.

4.5.3 Material selection and standards

The material specifications and their standards for major components of main inlet valve shall be as shown below. The material grade and classification wherever specified are obligatory and proposed equivalent national/international standard for the same shall also be considered if their chemical composition, mechanical properties, manufacturing methods are similar/superior and are suitable for proposed use. The Contractor shall establish the equivalence/superiority for acceptance by the Employer.

S.No.	Item	Material	Material Standard
1	Body	Carbon steel	ASTM A537 class 1 or ASTM A216Gr WCC
2	Rotor	Carbon steel	ASTM A537 class 1 or ASTM A216Gr WCC
3	Trunnions	Carbon steel	ASTM A216Gr WCC
4	Connection Sleeve/ extensions	Carbon steel,	ASTM A537 class 1
5	Permanent seat of seal, seal retainers, service seal and maintenance seal. and fasteners	Forged Stainless steel, 13Cr-4Ni	ASTM A473 UNS S41500
6	Accumulator	Seamless steel	EN 10028-3 P355NL1 or better
7	Servomotor cylinder	Carbon Steel Seamless Pipe	DIN 2391 (Part-2) ST52

4.5.4 Valve body

4.5.4.1 General

The valve body shall be in two pieces, made of welded plate steel, or of cast steel, or a combination of both, bolted together by hydraulically pre-stressed bolts. It shall be of rigid construction and adequately ribbed as necessary to minimize distortion under full load and maximum pressure. The trunnion bearing housings shall be integral with the valve body and supported by it. The valve body shall be provided with flanges for bolted connections to similar flanges on the valve body extensions. The valve body and rotor shall be machined only after it has been subjected to stress-relieving heat treatment.

The valve body shall be designed to avoid any abrupt changes in velocity. Water passage may be so shaped so as to give either constant velocity or gradual increase in velocity in the direction of flow. Minimum loss of head shall be kept in view while designing valve body, rotor and extensions.

4.5.4.2 Foundation Parts

The concrete foundation shall be designed and provided by the civil contractor in the first stage concrete. The Contractor shall design the necessary anchoring to be embedded in the concrete structure, for most severe load conditions. The valve body shall be provided with integral supporting feet designed for transmitting the full load, including the weight of the flanged extensions and contained water, servomotor thrust to base plates secured in the concrete pedestals. Provision shall be made in the valve feet for minimum 8-10 mm movement of the valve body assembly along the penstock axis. The necessary base or sole plates complete with anchor bolts shall be furnished.

4.5.4.3 Valve seals and seats

Two independent sets of replaceable and corrosion resistant steel seals shall be fitted, one on the downstream side (service seal) and other on the upstream side (maintenance seal) of the valve rotor. The service seal shall be arranged for automatic operation with the valves control system. The sealing of service seal shall be attained by means of hydraulically pressed ring using penstock water. The upstream maintenance seal shall also be operated with upstream water pressure with manual locking provision. Duplex filter with clogging indication shall be provided in penstock water tapping line to supply clean filtered water for service seal & maintenance seal engagement.

The material for service and maintenance seal shall be stainless steel. Other type of proven sealing arrangement/ sealing material in respect of service and maintenance seal can also be accepted subject to Employer`s approval.

The sealing surface shall be so designed /constructed that there is no jamming when water is drained from the generating unit after closure under full head and there is minimum damage on the seat and the seal.

The service seal adjustment feature may be accomplished by seal retaining elements from the downstream side of the valve. It shall be possible to adjust and replace the service seal from downstream side with the inlet valve closed.

The seal retainers, seal seat and fasteners shall be of 13Cr-4Ni stainless steel. The seals and the seats shall be designed and constructed of such material that they shall provide maximum tightness, maximum resistance to the silt, minimum maintenance, minimum leakage, convenient adjustment and replacement.

4.5.4.4 Permissible leakage

Maximum permissible leakage from the service seal shall not exceed one (1) lpm/meter periphery of seal.

Maximum permissible leakage from the maintenance seal shall not exceed three (3) lpm/meter periphery of seal.

4.5.5 Flanged extensions and erection joints

4.5.5.1 General

The valve shall be furnished with two valve body extensions, one for the inlet side of the valve and another for the outlet side. The extensions shall be of plate steel construction, designed for a hydrostatic pressure of 38 bars.

All necessary nuts, bolts and gaskets for the flanged connection between the valve body and the extensions shall be furnished by the Contractor. No special supports shall be provided for the extensions. Their weight, including contained water shall be carried through the flanged joints to the valve body.

4.5.5.2 Upstream connection

The valve body inlet extension shall be of Cylindrical cum conical shape and shall be provided with bolting flanges at one end for connection to the valve body. Extra length to accommodate any variations in the distance between penstock and valve flange for connecting the inlet extension to the valve body shall also be included in scope of supply. The connection of the upstream extension piece to the penstock shall be of welded type. The Contractor shall cut, chamfer and weld together the end of the penstock and the valve extension including all necessary NDT or heat treatment. Limit of supply of upstream extension piece is 11540 mm (tentative) from the unit centre line (C –Line upto reducer piece end length) which shall be finalised during detailed engineering. The contractor shall provide necessary suitable size openings for by-pass

valve and penstock drain valve arrangement. Entry point of penstock drain valve shall be in cylindrical portion (adjacent to penstock as possible) so that complete penstock can be drained as & when required.

The material of the penstock shall be ASTM A537 cl.1.

4.5.5.3 Downstream connection (Flexible coupling)

Downstream connection arrangement shall comprise of downstream sleeve with sleeve type coupling arrangement of approved type (not transmitting any axial load) and downstream conical/cylindrical shape extension sleeve. One end of downstream sleeve shall be bolted to the MIV flange and other end shall be connected to the spiral casing inlet flange. Downstream extension sleeve shall be furnished to connect the valve to Spiral casing. All cut, chamfer and welding and necessary NDT or heat treatment at MIV end and at spiral end shall be under the scope of E&M Contractor.

The coupling shall allow the valve to be displaced by approximately 15mm along the penstock axis due to hydraulic forces and thermal expansion/contraction and to facilitate erection and dismantling of the extension pipe for replacement of the inlet valve seal and to allow for any small differences in spiral casing length. The downstream extension shall be complete with all necessary steel flanges, seals/gaskets, coupling bolts and suitable size openings for by-pass valve, manhole, penstock drain arrangement and air release valve.

The surfaces of the coupling in contact with the seal, extension piece and the seal groove shall be plated / lined with stainless steel overlay of minimum 5 mm thick.

4.5.6 Valve rotor and Trunnions

4.5.6.1 Valve rotor

The valve rotor shall be made of cast steel in one piece, or of welded plate steel construction, or a combination of both, ruggedly designed and heavily ribbed internally to minimize deflection under load in the closed position. The diameter of the flow circular section shall be equal to the valve inlet diameter. The flow passage shall be such that any head losses and flow disturbances can be reduced to a minimum. The rotor shall be machined at its rim and provided with an approved replaceable type seal of corrosion resistant material at both ends. The rotor shall be designed with positive travel stop, both on opening and closure.

The surfaces of seat of the seals in contact with the rotor, flange and body shall be plated with stainless steel lining/overlay of minimum 5 mm thick.

4.5.6.2 Trunnions

The trunnions shall be made of forged or cast steel, and shall be bolted/ welded to the valve rotor. The rotor and trunnions shall be designed to

sustain maximum differential pressure across the valve in closed condition and emergency condition. The trunnion bearing and seal surfaces shall be provided with replaceable stainless steel sleeves. Appropriate seals shall be provided at the outside ends of the trunnion to prevent leakage. The design and construction of the seals shall be based on a recognized design giving due regard to dependability, long life, and convenient replacement.

4.5.7 Main bearings

The main bearings shall be self-lubricated, sleeve type, supported integrally within the valve body. The bearings shall be designed and constructed so that all necessary adjustments may be made from outside the bearing housings. The sleeve bearings shall be of corrosion resisting material and shall be designed so that deflection and trunnion slope caused by the water load on the rotor in the closed position shall not result in binding between the trunnions and sleeves. The bearing shall be built into the valve body and shall transmit the loads to body. The bearings of either side shall be interchangeable. The main bearing shall be designed for its in situ replacement.

4.5.8 By-pass assembly

Each main inlet valve shall have two (2) numbers of by-pass assembly of minimum DN 250 complete with hydraulically operated valve, piping and necessary electrical controls. Each bypass valve shall have guard valve at upstream side and isolating gate valves at the downstream side along with piping. Guard and isolating valve shall be provided with suitable type gear drive arrangement for ease of operation.

The opening and closing of the bypass valve shall be controlled by hydraulic pressure from the oil pumping unit.

Sizing of the bypass assembly, guard valve, isolating valve and piping shall take into account to maintain balance condition even if turbines guide vanes leakages have increased due to wear & tear, erosion and cavitation. The by-pass assembly shall be properly supported to minimise vibration and noise.

The by-pass , isolating and guard valves shall be of cast or forged steel with wearing parts of corrosion resisting material. A hand wheel mechanism for manual operation of the bypass valve shall also be provided, wherever feasible.

The by-pass line shall be used for filling the turbine spiral casing and equalizing the pressure across the main inlet valve rotor before opening.

Non-contact type hermetically sealed limit switches, each with electrically independent contacts, shall be provided as required to accomplish the specified control and alarm functions. The protection class for proximity switch and cables shall be IP 67. There shall not be any joint up to the Junction box. In case cable provided with proximity sensors are not of

sufficient length to reach junction boxes, connection boxes shall be used with IP67 protection class.

4.5.8.1 Pressure gauge and switches

Necessary pressure gauges, pressure switches, pressure transducer including differential pressure gauges & switches shall be provided for visual measurement and to accomplish the specified controls in the upstream and downstream side of the valve rotor.

4.5.8.2 Piping

The by-pass piping shall be schedule 80 seamless carbon steel with flanged connections. The necessary bolts, nuts and seals/gaskets shall be furnished by the Contractor to make the system complete. The pressure rating of valves shall not be less than PN 40. Air release valve shall also be provided at highest point.

4.5.9 Valves

4.5.9.1 Air Inlet and Vent valve

An automatic air admission and air release valve complete with a service gate valve and the necessary bolts and gaskets shall be furnished for installation on top of the downstream extension pipe. The size of the valve shall be as required to exhaust the air trapped in the spiral case when the by-pass is opened for filling the spiral case and to admit air when the main inlet valve is closed and the spiral case is being drained. The air and vacuum valve shall be designed to prevent any water spray during its operation.

4.5.9.2 Penstock drainage system

The penstock shall be drained through turbine up to tail water level. In order to evacuate the remaining quantity of water, a penstock drainage system shall be installed. One no. heavy duty gate valve of suitable size and made of forged or cast steel along with one additional guard valve at upstream shall be provided. An additional suitable thruster compensator arrangement of pressure rating not less than PN40 shall be installed to cater any vibration. The drain arrangement shall have adequate flexible telescopic coupling arrangement to cater the thermal expansion/ contractions of the penstock.

The penstock drain arrangement i.e. inlet of penstock drain valve shall be connected though boss to the downstream extension sleeve along with stainless steel grating. The drain pipe shall be seamless carbon steel of minimum schedule 80.

The pressure rating of the valves shall not be less than PN 40

4.5.9.3 Service seal Control Valve

A hydraulically operated service seal control valve of suitable size complete with necessary control and required piping shall be provided. The valve operation shall be controlled by hydraulic pressure from OPU.

The valve shall be cast or forged steel with wearing parts of corrosion resisting materials.

"Open", "intermediate", "close" hermetically sealed proximity limit switches, each with two electrically independent contacts, shall be provided, as required to accomplish the specified control and alarm functions.

The valve shall be used for pressurisation and depressurisation behind the service seal, for operation of valve.

4.5.10 Operating mechanism

The main inlet valve operating mechanism shall consist of two double acting servomotors with base plate and anchor bolts and connecting linkage for opening and closing by oil pressure. The lever shall be made of steel and shall be keyed to the valve trunnion. The operating mechanism shall have sufficient capacity to move the valve rotor smoothly through one full opening and two closing strokes under conditions specified in Clause 4.2.2 “Operating conditions”, with the minimum operating oil pressure.

The operating mechanism shall be of sufficient capacity to close the valve in 60 seconds. The opening time shall be approximately equal to the closing time. The closing and opening times shall be adjustable between 60 and 120 seconds with positive means for locking these adjustments. The minimum permissible closing time shall be controlled by a fixed orifice installed directly at the servomotor outlet as to prevent fast closure of the valve in case of oil piping failure. The main inlet valve shall be opened normally in balanced conditions or with a maximum difference of pressure of 50% between both sides. The valve shall be designed to be capable of closing under 100% unbalanced condition at maximum flow.

The angular travel of the rotor shall not be more than 90 degree from open to shut-off position.

The operating mechanism shall include suitable positive stops to limit the rotor travel at the fully opened and fully-closed positions. A mechanical position indicating device shall be provided on the operating mechanism to indicate the position of the valve rotor.

Provision shall be made to manually lock the main inlet valve in closed position. Lock shall be capable of holding the main inlet valve in the closed position against full combined force of both the servomotors. Parts with sliding contact shall have self-lubricating bushing and corrosion resistant shafts with surfaces finish and coating as required.

All pilot and control valves, limit switches and interlocks necessary to coordinate the operation of the lock with the main valve and bypass valve sequence of operation shall be provided. When the valve is locked in the closed position, the electric circuits for opening the valve shall be inoperative. Provision shall also be made for padlocking the locking device when in the closed position.

The supply shall include the hydraulic control system complete with the necessary valves, piping, fitting and filters etc. for the operation.

4.5.10.1 Servomotor

The servomotor cylinder body shall be accurately bored to receive the piston. The servomotor shall be provided with suitable gaskets or seal rings designed to remain oil tight at maximum operating pressure.

The operating cylinders shall be sized to open and close the valve with minimum system oil pressure and to retard closing under the most adverse combination of counterweight force and hydraulic torque on the valve rotor due to emergency closure at maximum turbine discharge without exceeding the cylinder design pressure.

The piston rod connecting the piston to the operating linkage shall be hardened, corrosion resistant steel and shall be provided with hard chromium layer. The pistons shall be provided with approved type packing and piston rings suitable for the required oil pressure service.

There shall be positive margin in the cylinder with respect to full stoke length or any other alternate arrangement either in piston or cylinder for avoiding seizing of Servomotor when fully opened for longer period. Servomotor layout shall be designed to be vertical at fully open and close positions

4.5.10.2 Counter weight

The counterweights shall be sized to provide net closing torque on the valve rotor under all possible operating conditions. Counter weight shall be directly mounted on trunnions and shall have smooth finish, as to be approved during detailed engineering

4.5.11 Oil pressure system

4.5.11.1 General

Each unit shall have an independent oil pressure system for operation of the main inlet valve for the operating mechanism, servomotor and controls. The oil pressure system shall consist of a sump tank, two (2) AC motor driven screw/ vane /piston pumps of suitable capacity, pipes, fittings etc.

The design shall be compact, and there shall be easy access to all the components for maintenance and replacement. All the components shall

be selected to assure high reliability, long life, low noise and minimum heating of the oil.

4.5.11.2 Operating pressure

The normal operating pressure of the oil pressure system shall be approximately 100-160 bars and medium shall be nitrogen/oil.

4.5.11.3 Oil pumps

Mounted on the oil sump tank, two oil pumps shall be provided, one acting as “main” and the other as “standby”. Each oil pump for the oil pressure supply system shall be independently driven by a 3-phase 415V AC electric motor and each shall have a capacity sufficient to operate the complete main inlet valve oil pressure system. A complete pump logic control system shall be provided that shall permit the selection of either pump, as the main unit with the other pump acting as a standby, which shall cut in automatically to supply the oil and close a set of alarm contacts.

Each pump shall have following devices/ provisions:

i) One electrically controlled loading / unloading valve at the outlet, so that it discharges to the sump at reduced pressure or accumulator. It shall be possible to run one main pump continuously without overheating the oil.

ii) At the outlet, one safety valve which shall be adjusted to open at more than the maximum operating pressure as per manufacturer recommendation and shall be sized to pass the pump full flow with pressure increase less than 10 %.

iii) Hand operated valves at the outlet of the pump, to permit isolating of pumps from the oil pressure.

iv) A suitable oil strainer in the suction line,

Each main and standby oil pump shall be of the screw/ vane /piston type, with a capacity (l/ minute) as per IEEE125 when operating under the pumping pressure recommended by the Contractor. Each pump shall be self-priming under maximum oil pressure.

Each pump shall be direct-connected to a 415 V, 3 phase, 50 Hz, squirrel-cage, low starting current, induction type motor designed for full voltage across the line starting and conforming to IEC standards, with class F insulation. The motor shall have windings with moisture and oil-resistant insulation. The windings shall be braced for line start application. The capacity and torque shall be suitable for the pump requirements.

The pumps operation shall be as follows:

a) No load starting by returning the oil flow through a unloading valve

b) In case of pressure drop, the main pump shall start and keep the pressure within the operating limits by closing and opening the unloading valve i.e. restore the pressure and then stops

c) In case of excessive pressure drop the standby pump shall start, both main and standby pump running together shall restore the pressure and then stop.

d) In case of failure of main pump, the standby pump shall automatically be considered as main.

e) Automatic changeover from main to standby on the basis of set time running hours.

All valves and mechanisms shall be accurately set and tested in the shop before delivery.

Combination heavy-duty magnetic starting contactors with fused disconnecting switches and three thermal overload devices shall be furnished and shall be mounted on or adjacent to the pump units.

A 415/240 V control circuit transformer shall be provided within each magnetic starter enclosure, of suitable size for control of the starter and supply to the starter accessories. Suitable terminal blocks with marking strips shall be provided in accessible places for the control wiring. All control equipment shall be suitable for operation from the 220 V control circuit transformer. The control equipment shall include a timer, adjustable from 0 to 60 seconds which shall prevent simultaneous closing of the magnetic starters when the power supply is removed and then restored.

A manual control switch shall be provided to select one of the two pumps as the lead pump. An alarm shall be provided to indicate continuous running of the lag pump over on adjustable period of time.

The unloader valves shall be operated from the accumulator pressure by pilot lines, complete with isolating valves and filters or by pressure switches and shall be equipped with “snap” action pilot valves. Hand-operated valves shall be provided to permit isolating pumps from the oil pressure. Adjustable temperature switches with two (2) electrically separate contacts suitable for operation at 220 V DC located in the sump tank for oil high temperature alarm shall be provided.

The connections to all pumps shall be arranged so that any pump may be removed for repair or replacement without interfering with the continuous operation of the system.

4.5.11.4 Oil sump tank

The inlet valve system shall be supplied with a sump tank of sufficient capacity to hold at least 10 percent more than the total quantity of oil in the entire inlet valve system including oil accumulator. The sump tank shall be designed and have connections for venting and overflow.

The sump tank shall be provided with a manhole of 500 mm diameter with a suitable oil resistant gasket for access to the interior of the tank. A

suitable magnetic oil level gauge shall be provided to indicate the level of the oil in the tank, marked with low and high level marks, complete with both hand shut-off valves and automatic means of shutting off oil discharge in the event of breakage.

Suitable connections for filling and draining the tank, and connections for an oil purifier shall be provided. The oil purifier connections shall consist of two pipe outlets and valves, one located near the bottom on one side and the other near the top on the opposite side. A vertical filter screen shall be arranged to divide the sump tank into “clean” and “dirty” oil compartments. All strainers shall be readily removable for cleaning. The outlets of all oil pipes to the sump shall be below low oil level. Any component that requires adjustments shall not be located inside the sump tank. Low and high level switches shall be provided for sump tank, suitable for 220 V DC, which operate alarms whenever the oil level reaches the present level. An oil temperature switch wired to cut off power supply to the oil pumps in the event of high temperature shall also be provided. Moisture indicating device shall also provided for moisture indication. Moisture cum air breather of capacity equal to main & standby pump rating shall be provided on the top of tank.

A) Control valve oil filtering

Suitable dual on line oil filter with changeover and clogging indication shall be provided in main inlet valve actuator supply circuit to ensure that impurities as recommended by the manufacturer are avoided. Clogging indicators with electrical contacts to indicate the clogging of filters shall be provided. Filter elements used shall be cleanable with Petrol.

B) Main circuit oil filtering

One oil filter shall be provided in the pumps unloading discharge line to ensure the main circuit impurities as recommended by the manufacturer are avoided. One duplex filter shall be provided in the return line. Clogging Visual indication with electrical contacts to indicate the clogging of filter shall be provided. Filter elements used shall be cleanable with Petrol and easily changeable. Main circuit oil filter shall be equipped with one automatic by-pass allowing operation in case of clogging of the filter element.

The filter system shall be able to handle the discharge flow of both main and standby Pumps.

C) Cooling system

If required, one heat exchanger shall be provided to maintain the oil temperature within 50°C. The heat exchanger shall be installed on the unloading return line to the tank and shall be sized for continuous operation of the main pump maintaining pressure between operating limits and limiting the water temperature increase not to more than 4°C. Temperature indicators on both sides of coolers shall be provided.

4.5.11.5 Oil leakage unit

The leakage oil units, if required, shall be provided for the collection of oil leakages from the servomotors and in the event of maintenance for draining the servomotors; oil pipelines and guide bearing. The tank shall be provided with suitable gauge glass, level switches for automatic start/ stop of the pumps and provision for alarm in case oil level is high. The units shall be of suitable capacity along with pump-motor, pipes, valves, float switches, and auto provision for start / stop etc.

4.5.12. Oil pressure accumulator

4.5.12.1 Capacity

The size of the accumulator shall be such that it shall be possible to operate the main inlet valve three (3) times (2 “C”+1 “O”) from minimum normal working/operating oil pressure to minimum allowable pressure without the operation of main inlet valve oil pumps and without dry nitrogen admission and shall be designed for a pressure ten(10) percent above the actual maximum system pressure. Design of the piston accumulator shall be such that the same shall be accommodated on the turbine floor.

4.5.12.2 Construction and safety features

The accumulator shall be constructed from seamless steel conforming to EN 10028-3 P355NL1 or equivalent in accordance with part UW of the ASME Code for Unfired Pressure Vessels, Section VIII, for the maximum working pressure of the system.

The accumulator shall be painted on the outside as per approved painting system. The inside of the accumulator shall be very high surface finish for sealing rings of piston for its smooth movement. Prior to shipping, all threaded openings shall be closed with standard pipe plugs. Flanged openings shall be protected with blind flanges with gaskets bolted in position.

All connections to the accumulator, with the exception of the nitrogen supply and the upper gauge connections etc. shall be made below the low oil level and shall be designed to prevent foaming. Bypass valves shall be provided to drain the accumulator into the sump for cleaning or repairs.

The accumulator shall be equipped with a pressure gauge, a safety relief valve, pressure transducer, and oil-level sight gauge metallic magnetic float pipe type with indication, switches and transmitter. The safety relief valve shall be set to open at 110 percent of the maximum operating pressure of accumulator. The sight gauges shall be long enough to overlap the high and low oil levels by at least 50 mm. The safety relief valve should release nitrogen to atmosphere in a manner not injurious to personnel or equipment in the vicinity of the accumulator.

Pressure switches shall be of approved make. In addition to echelon control, the following provisions shall be made for each accumulator.

i) Normal pressure signal for unit start interlock,

ii) Inlet valve oil low pressure alarm to the station annunciator,

iii) Extreme low-pressure trip and unit shutdown interlock,

iv) Suitable connection for Pre- charging kit for charging of nitrogen system.

All Instruments necessary for proper and safe operation of the unit shall be supplied with at least:

a) One oil pressure transmitter

b) One oil level transmitter with switch for normal oil level unit start interlock.

c) Low level switch - alarm

d) Low level switch – Unit trip

e) Very low level switch – Unit trip and close isolating/ float valve

All transmitters shall be 4 to 20 mA type. Contractor is free to use individual suitable pressure and level switches. In this case, all contacts shall be adjustable electrically separate and suitable for 220 V DC operation.

The pipe connections for all pressure and level switches shall be independent of the oil supply lines to the servomotors and shall be provided with individual shut off valves and bleed valves as necessary.

In addition to above, one pressure transducer for nitrogen gas shall be installed for monitoring the nitrogen gas pressure through plant SCADA System.

4.5.13 Miscellaneous components

4.5.13.1 Lifting and handling fixtures

The Contractor shall provide lifting fixtures and special tackles and devices for handling of major components of main inlet valve like valve body, rotor, transition sections, servomotors, counterweight, bearings etc. These devices shall include at least the following:

i) Two (2) sets valve handling and lifting device for handling and lifting the assembly of valve in-situ,

ii) Two (2) sets valve rotor lifting device and set of special polyester slings for lifting and handling the valve rotor, servomotors, levers, counterweight etc.

4.5.13.2 Nameplate

A rating nameplate of stainless steel material shall be attached to each major item of equipment supplied. This plate shall be permanently engraved with the designed full load ratings, serial number, type number, date of manufacture and other identification deemed necessary. Hydraulic and electric control system diagram plates shall also be supplied. The material and the identifying inscription shall be approved by the Employer.

4.5.13.3 Access platforms, hatch cover, floor grating and stairs

Walkway, platform, staircases, hand-rails etc shall be provided for convenient and safe access to all operating equipment and points of lubrication. Also chequered plate/ grating covers shall be provided for equipment handling hatches and opening/ trenches for cable, cable trays, pipes, ducts or any other trench/ opening required for completing the floors around and over the works supplied under the contract.

The material for all handrails shall be stainless steel. Gratings for hatches, platform, walkways, staircases etc. shall be factory made; fabricated mild steel electro forged conforming to relevant standard.

4.5.14 Auxiliary system

4.5.14.1 Oil and water piping

All Oil piping shall be seamless stainless steel of minimum schedule 80 except drain which shall be stainless steel of at least schedule 20 and shall include all piping to the oil pressure supply system consisting of sump tank, accumulator, servomotor, cabinet instrumentation etc. as required. The piping shall be of such size that the maximum oil velocity shall not exceed 3.0 m/sec in the pressure lines and 1.5 m/sec in the return lines. Minimum pressure anywhere in the oil piping system during maximum speed of valve operation shall not be less than 0.5 bar absolute.

The entire piping system shall be welded, insofar as practicable, leaving only such flanged connections as may be necessary for erection or possible subsequent dismantling for repair.

The piping shall be thoroughly pickled, cleaned, and the interior coated with oil before shipment. Prior to shipment, blind flange with gaskets on the flanged connections, screwed caps on the threaded ends and suitable plugs in plain ends shall be provided to prevent the entrance of foreign matter into the piping during shipment or while awaiting installation.

Water piping shall be made of heavy duty seamless steel pipe in accordance to GTS clause 5.7 and shall have flanged connections as may be necessary for erection or possible subsequent dismantling for repair

4.5.15 Control and monitoring

4.5.15.1 General

The main inlet valve and associated accessories/equipment shall be controlled and monitored at three levels:

i) By respective local control cubicles,

ii) By respective Unit Control Boards,

iii) By Computerized control and monitoring (SCADA) system through Unit Control Boards.

The details of control and monitoring requirement are defined in “Section 15 - Computerized Control and Monitoring System” and “Section 16 - Protection System”.

The Contractor shall make provision of contacts and/or ports in local control cubicles for interfacing with SCADA system for control and monitoring.

The normal control by the SCADA system shall be through Unit Control Boards. It shall be the responsibility of the Contractor to make all necessary provisions required to achieve seamless and compatible interfacing of the system with SCADA system.

Local control shall be performed in an independent and standalone manner, and all information (faults, alarms, measurements, status) necessary for such control shall be displayed locally.

If the system consists of redundant subsystems, the priority of operation of such subsystems shall be selectable either from SCADA system or locally.

4.5.15.2 Instrumentation

Indicating instruments as required shall be installed on local control panel and indications may be replicated in Local Control Board/ control room for common services. Control and monitoring system requirement as defined in “Section 15 - Computerized Control and Monitoring System” and “Section 16 - Protection System” need to be fulfilled.

The main inlet valve control system shall be provided with at least the following to accomplish the specified alarm, indications and interlocking function.

i) Pressure gauges, pressure transducers and switches for measurement and detection of the pressure in the MIV downstream side and upstream transition section,

ii) Differential pressure switch and gauge for upstream and downstream valve rotor pressure

iii) Suitable nos. of pressure and level switches/ transmitter for auto operation of the pumps, nitrogen admission start-stop and annunciation purposes in the accumulator,

iv) Auto selection of OPU pumps on account of running time and mechanical & electrical fault.

v) Level switches and level indicator for sump tank and accumulator,

vi) Linear displacement transducer (LDT) for position and velocity measurement of the accumulator piston.

vii) Non contact type position switches for fully open, partly open, partly closed and full closed valve position for main inlet valve.

viii) Non contact type position switches for fully open and fully closed, position of by-pass valve.

ix) Non contact type position switches for indication/interlocking purposes for the valve manual locking mechanism,

x) Non contact type position switches for detection of engaged-released position of valve main service seal and maintenance seal,

xi) Non contact type position switches for indication/ interlocking purpose of Service seal Control valve.

Any other instrumentation required during detailed engineering shall be provided.

Non-contact type proximity type limit switches, each with electrically independent contacts, shall be provided as required to accomplish the specified control and alarm functions. The protection class for proximity switch and cables shall be IP 67. There shall not be any joint up to the Junction box. In case cable provided with proximity sensors are not of sufficient length to reach junction boxes, connection boxes shall be used with IP67 protection class.

4.6 Drawings, Documents and Design Calculations

4.6.1 Design memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1-General Technical Requirements.”

4.6.2 Drawings and documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 – Technical Documents” of “General Technical Specification (GTS)”.

4.6.3 Design calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance.

i) Structural and stress analysis of different parts of main inlet valve components in all loading conditions,

ii) Calculation of hydraulic forces and torque on the valve rotor, trunnion and body during opening and closing of the valve for different positions of the valve and different turbine flow conditions,

iii) Calculations of sizing of bypass valve,

iv) Calculations of foundation loads,

v) Oil pressure system pump-motor capacity calculation.

vi) Calculation of sizing of inlet valve servomotor and stress calculation.

vii) Size and plate thickness calculation for accumulator and piping,

viii) Sump tank sizing calculation,

The Contractor shall also provide other calculations as required by the Employer for his approval of the Contractor's design

4.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 – General Technical Requirements."

4.8 Spare Parts

Specified spare parts to be supplied under this section are as follows:

S.No.	Description	Quantity
1	Pressure oil pump motor set	2 nos.
2	Unloader valve complete assembly	2 nos. of each type
3	Safety relief valve complete assembly	2 nos. of each type
4	Set of Oil filters of each type used in the electro hydraulic actuator and pumping set (except pump suction filter)	4 nos. of each type
5	Level switch, level gauge, sight glass and level transmitter	2 nos. of each type

S.No.	Description	Quantity
6	Pressure switch, pressure gauges, Pressure transducer	2 nos. of each type
7	Thermometer ,temperature sensors	2 nos. of each type
8	Non contact type position switches	Total numbers required for 2 units
9	Servomotor complete set	1 set
10	Main inlet valve seal set each consisting of service seal and maintenance seal including fasteners and seal retainers	2 sets
11	Complete Hydraulic bypass valve assembly	2 nos.
12	Guard valve & isolating gate valve of by-pass valve	2 nos.
13	Set of bushes for main Trunnions	2 Sets
14	Solenoid valve	2 nos. of each type
15	Solenoid Coils	Total numbers required for one (1)unit
16	Air vent and admit valve with isolating valve	2 Sets.
17	Oil pump suction strainer/ filter set	2 sets
18	Moisture cum air breather	2 nos. of each type
19	Charged Nitrogen cylinders	Total nos. required for one (1) unit
20	Control valves	2 nos. of each type
21	Set of regulating valves, hoses, couplings, pressure gauges etc. for Nitrogen cylinder	5 nos.
22	Transducers assemblies complete of all type used in the system	2 nos. of each type
23	All oil valves of each type	2 nos. of each type.
24	Penstock drain valves, MIV body drain valve	2 nos.
25	All seals (cup seal, rubber cord, 0-Rings, packing, gaskets etc. complete set of servomotor seal kit with bush)	2 sets

S.No.	Description	Quantity
26	Coupling studs/bolts with nuts of MIV body, MIV upstream flange connection, dismantling joint and spiral casing	25% of total quantity for one unit.
27	Indicating lamp bulbs/LED for each colour(Red, Yellow, Blue, Amber etc.)	10 nos. of each type
28	All valves, filter cartridge and pipe fittings of each type of service seal and maintenance seal operation water circuit	2 nos. of each type.

One set is defined as 'Total quantity installed for one MIV'.

The contractor shall furnish the list of recommended spares in accordance to Clause 1.8 "Spare Parts" of "Section 1 – General Technical Requirements".

4.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 "Tools and Instruments" of "Section 1 - General Technical Requirements".

4.9.1 Special tools

The Contractor shall list and supply all special tools. List of such tools including their make and detailed specification, shall be submitted for acceptance by the Employer.

4.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements specified separately in "Quality assurance and Testing Specifications (QTS)".

13.0 DC SYSTEM

13.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Owner's personnel, handing over to owner and guarantee for two years of DC system as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

13.1.1 DC system

i) Two (2) sets of 220V Lead acid Plante type 1000 Ah or of higher capacity battery banks complete with terminal connections, hardware, connecting cables and associated accessories,

OR

ii) Two (2) sets of 220V Ni-Cd (FNC) type/ Pocket plate high discharge type (KOH) 800 Ah or of higher capacity battery banks complete with terminal connections, hardware, connecting cables and associated accessories,

iii) Two (2) sets of 220V Float Cum Boost chargers,

iv) Two (2) numbers 220V DC distribution boards for power house area,

v) Two (2) sets of 10 kVA Industrial grade inverter comprising of AC bypass with static control voltage stabilizer (SCVS) along with its distribution boards,

vi) 48V DC distribution board with redundant 220V/48 Volt DC-DC converters of 60 A rating for OLTE equipment/ PLCC panels etc.

vii) Seismic-proof racks, hardware, interconnecting cables and other accessories etc for each bank of batteries,

viii) Coordination and Provision of necessary contacts and/or ports for integration with plant SCADA system

ix) Spare parts in accordance to clause no. 13.8 "Spare Parts" of this section.

x) Tools & instruments in accordance to clause no. 13.9 "Tools and Instruments" of this section

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

13.2 Specific Parameters and Layout Conditions

13.2.1 Layout and General Arrangement

The 220V DC system in the power house shall have provision for boost and float charging and distribution boards. A tentative arrangement is proposed in the single line diagram no. NH/DEM/ URI I STG II /DC/01 or NH/DEM/ URI I STG II /DC/02 as applicable..

220V DC system shall be capable to supply following loads of power house:

i) Generator field flashing

ii) All control, monitoring and protection circuits of Power House including GIS hall, Pothead yard etc.

iii) Motors for GIS spring charging mechanism (if applicable)

iv) Generator HS Lubrication pump

v) DC emergency lighting of Power house complex including GIS and pothead yard area

vi) Inverters for AC emergency lighting system of Power house complex including GIS building and DG building/control room/panel room in pothead yard area

vii) Inverters for Control & protection circuit, emergency lighting in Control room, etc. of Power house complex

viii) Any other Location / duties

The 48V DC system comprising of 220V/48 Volt DC-DC converters of 60 Amp rating will serve the consumers particularly in the PLCC communication system/ OPGW Communication system.

The inverter will be connected to the 220V DC system and a distribution board. The inverter will serve essential consumers of the control system, power outlet circuits of control room, office areas and individual sockets intended for electronic appliances and computers, monitors, printers etc.

The AC power supply of 220V DC shall be taken from station service boards and the chargers shall be so designed that they can give full float and boost charging currents within the given voltage variation.

Each set of battery bank of 220V DC shall be capable of supplying successfully total station loads of 220V system for at least ten (10) hours without any assistance from the charger and without its terminal voltage falling below 198 V.

The capacities of the batteries and inverters given in this specification are estimated values. The Contractor shall make detailed calculations based on the actual power consumption of the connected equipment and submit these data to the Engineer for approval. In case actual power consumption comes out to be higher,the contractor shall have to supply the batteries as per actual capacities. However, in case actual power consumption comes out to be lesser, the Contractor shall have to

manufacture and supply the batteries as per the capacities mentioned in the specifications.

13.2.2 Design considerations

The basic description of scheme for 220V DC system and 48 V DC system shall be as per drawing no. NH/DEM/URI I STG-II/DC/01 or . NH/DEM/URI I STG-II/DC/02 as applicable. The DC supply shall be made available to GIS, pothead yard area and other far off areas. The scheme for these areas shall be finalized during detailed engineering.

The battery will furnish practically all the heavy current demands required for operating contingencies such as failure of AC supply or when charger is under maintenance etc.

Suitable interlock operation shall be provided between float charger and boost charger, float charger output circuit breaker and bus tiebreaker, incoming breakers of DCDB and boost chargers.

Normally, both inverters at their reduced rating shall share the total inverter load equally. However, in case of failure of any of the inverters, other shall be capable to supply total AC load connected to inverter system.

All required protection system as described in “Section-15-Protection system” shall be provided. The potential free contacts for alarm/ trip function and measurement signal of current and voltage shall also be provided for interfacing with the Plant SCADA.

A) 220V DC System:

If the offered system is SCR based :

220V DC system shall consist of two nos. battery bank, two identical chargers each complete with float charging and boost charging functions are required as depicted in drawing no. NH/DEM/URI I STG-II/DC/01. Normally, each of the two float chargers shall supply one half of the total DC load and also be supplying the trickle charging current for one battery bank. In case of failure of any of the float chargers, the other should be able to supply the complete DC load and trickle charging current to both the battery banks.

Each boost charger shall be used for charging one battery bank speedily. During boost charging, the load would be continued to be met by float charger.

In case of main AC failure during boost charging, the load shall be supplied instantaneously by the battery through the tap cell and subsequently the total battery shall be connected to the load through the DC contactor.

If float charger fails during boost charging, the boost charging is continued by boost charger and the load is supplied through the respective tap cell.

Provision shall be made so that each of the boost chargers can be selected to charge any one of the battery banks at a time.

If the offered system is SMPS based:

220V DC system shall consist of two nos. battery banks , 02 nos. (2X100% Float cum Boost Charger SMPS based having MOSFET).The two identical chargers each complete with dual float cum boost charging functions as required as shown in SLD NH/DEM/URI I STG-II/DC/02.Normally,two float cum boost charger (of one battery bank) shall supply one half of the total DC load and also be supplying trickle charging current for one battery bank. In case of failure of any one, out of the two float cum boost of one battery bank, the other healthy FCBC should be able to supply the respective DC load and trickle charging current to respective battery bank. Tie breaker is to be provided so that in case of failure of both float cum boost charger os a particular battery bank, the battery will be fed from other section of float cum boost charger and set in trickle charging mode and at the same time the healthy charger is able to cater complete DC load.

Whenever a battery bank requires boost charging, one of the FCBC of that battery bank will switch to boost mode and charge the battery in boost mode. During boost charging ,the load would be continued to be met by other FCBC. In this condition if the charger in float mode fails ,the other FCBC which was in boost mode shall switch back to float mode and supply the respective load, and during the changeover from boost to float mode, the load shall be supplied through tap cell.

In case of main AC failure during boost charging, the load shall be supplied instantaneously by the battery through tap cell and subsequently the total battery shall be connected to the load.

Provision shall be made that each battery bank can be charged through FCBC charger of the other bank.

B) 48V DC System:

In case of 48V DC system, two identical 220 to 48 V DC converters are required. Normally, one converter shall supply the total DC load. In case of failure of any of the DC Converters, the other should be able to supply the complete DC load. Alarms and annunciation signals shall be available in converter units for monitoring and integration to SCADA.

13.3 Rating and Functional Characteristics

13.3.1 Rating

The capacities of the batteries and inverters given in this specification are estimated minimum values. The Contractor shall make detailed calculations based on the actual power consumption of the connected equipment and supply the system according to the actual requirement. In case actual power consumption comes out to be lesser, the Contractor shall supply the equipment as per the minimum capacities mentioned in the specification.

13.3.1.1

The Rating and functional characteristics specified hereunder are of Lead Acid Plante type. In case of Nickel- Cadmium type the same shall be decided during detail engineering and subject to Employer's approval**.**

Battery Chargers

AC Power supply	415 ± 10 %V,3-phase, 4 wire
Frequency	50 ± 5% Hz
Nominal DC output voltage	220V adjustable (for charger) / 48V adjustable (for 220 V to 48 V Converter)
Voltage Regulation (From no load to full load)	±1 %
Ripple of output voltage (peak to peak) With battery connected Without battery connected	 < 1 % RMS < 1 % RMS
THDi(Current harmonics)	Less than 15-20% at rated load as per IEC 61000
Efficiency of the system	Min. 90% at rated load

Batteries

A	**220 V Battery bank**	**Lead Acid Plante type**
i)	No. of battery bank	2
ii)	No. of cells in each battery bank	108
iii)	Nominal cell voltage	2V
iv)	Cell float voltage	2.25 V
v)	Nominal end cell voltage	Min 1.85 V at 10 hour rate
vi)	Minimum Ampere-Hour capacity of each battery bank (10 hour discharge rate to 1.85V /cell at 27^{O}C)	1000 Ah

13.3.1.2 Inverters

Rated capacity	10kVA (minimum) at cos ϕ = 0.8 lag.
Grade	Industrial

Rated input voltage (DC)	220 plus (+) 10%/ minus (-) 20% V DC
AC bypass with Static stabilizer	3 phase 415V, Neutral Fully loadable
Rated output voltage (AC)	3 phase 415V, Neutral Fully loadable
Rated frequency of output	50Hz
Voltage regulation	± 2 %
Frequency	50 ± 0.5 % Hz
Wave form	Sine, with max. 5 % THD at linear load Sine, with max. 7 % THD at 100% non-linear load
Overload capacity for 100 ms	2 times rated current
Overload capacity for 1 min	1.5 times rated current

13.4 Performance Guarantee

The DC system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

13.5 Design and Construction

13.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

Standards	**Description**
IEEE Std 485	IEEE recommended practice for sizing Lead Acid batteries for stationary applications.
IEEE Std 1115	IEEE recommended practice for sizing Nickel Cadmium batteries for stationary applications
IS 1652	Stationary cells and batteries, lead-acid type with Plante positive plates-specification
IEC 60146	Semiconductor converters.
IEC 60439	Low-voltage switchgear and control assemblies.

Standards	Description
SMPS Charger	Emission: EN 61000-6 -4:2007 (CE& RE CLASS A) Immunity: EN 61000-6-2:2005 Safety Standard: EN 60950-1(CE). It shall be CE certified

13.5.2 DCDB Cubicles

DCDB cubicles shall be of free floor-standing type, of manufacturer's standard production of protection class IP 52. Each cubicle shall be divided into sections or compartments, for housing the respective equipment. The circuit breakers for the outgoing feeders in the main distributions shall be housed in one compartment. Also, separate vertical cable compartment shall be provided. On, Off and trip indication shall also be provide with each outgoing feeder. Positive bus to ground and negative bus to ground voltage transducer shall be provided for remote indication in SCADA.

13.5.3 Battery chargers

Dry type transformers(Cu winding, Class F Insulation with Temp. rise limit to Class B) and static type rectifiers shall be used throughout for SCR based system.

For SMPS, for switch mode rectifier the transformer shall be of ferrite core type and should be preferably in-built in each rectifier module. Battery charger system shall be static type composed of switch mode power supply (SMPS) modules or SMR modules. The rectifier module shall be microprocessor controlled, Power MOSFET based, high frequency with active load sharing, modular in construction designed for single and parallel operation with battery and shall be provided with heat sink having their own heat Dissipation arrangements with forced air cooling of temperature based ON/OFF cooling system

The battery charger cubicle shall be provided into separate compartments for each of the twin battery chargers and the respective main circuit breakers. The charger cubicles shall be provided with a protection class of at least IP 42.

The chargers will be protected against harmful overload by a drooping characteristic, which transfers all loads in excess of the capacity of the chargers to the battery. The battery chargers shall be connected in parallel with the corresponding battery through the main distribution bus bar.

The chargers shall be completely equipped for a fully automatic and controlled charging and floating charge of the batteries, and shall be of the constant voltage type with current limiting devices.

Complete control and supervision equipments such as circuit breakers, ammeters and voltmeters, earth leakage meters and alarm indicating devices shall be incorporated with each charger.

At least following alarm devices shall be provided for alarm/indication on the charger.

1. AC Mains Fail
2. Float Charger Failure/Fault
3. Boost Charger Failure/Fault
4. AC & DC Over voltage
5. DC Under voltage
6. DC Ground Fault

Necessary alarm/potential free contacts/communication ports shall be provided for remote indication and alarm at SCADA level in accordance to clause no. 13.5.7.

The battery charger shall have provision for automatic temperature compensation of charging current.

The equipment shall have provisions for testing the ground resistance alarm device on both poles (plus and minus).

13.5.4 Batteries and battery racks

The individual Flooded Lead Acid Battery cells shall have removable top cover and a float to showing the electrolyte level in the battery. The polarity of the batteries shall be engraved and shall be easily legible.

Each battery assembly shall be complete with racks, flexible connections between the cells and a cable terminal box containing the battery dc MCCB (2 poles). Inter cell connectors shall be insulated type. Adequate alarm devices (with auxiliary contacts for remote indication) shall be provided with the battery DC MCCB in order to indicate the tripping of this MCCB.

Battery racks for supporting battery cell shall be free standing type constructed from structural steel frames forming a rigid structure. Racks shall be painted with at least three coats of electrolyte- resistant paint of approved shade. The battery racks shall be designed to withstand earthquake forces as laid down in “Section 1 - General Technical Requirements” without damage to the batteries. The batteries shall preferably be arranged in not more than two levels. The connecting points of the cells shall be easily accessible for the periodic checks of the cell voltage.

13.5.5 Inverters

Static inverters of on-line type shall be installed nearby to the 220V DC main distribution board and be suitable to feed continuously the essential loads. The static inverter will be connected to the 220V DC system and a distribution board. Normally inverters will use 220V DC source as main source and AC supply shall be used as bypass source. The Bypass source shall be provided with static voltage stabilizer. The inverter will

serve essential consumers of the control system and individual sockets intended for electronic appliances and computers, monitors, printers etc. The inverter cubicles shall be provided with a protection class of at least IP42.

The essential consumers of AC emergency lighting system in all areas, entry, exits, stairs, barrels, unit wise loads and Security & Surveillance system etc. shall be served by separate inverter system covered under "Section- 19, Illumination System"

The inverter panel shall include:

- Electronic switches and all accessories for uninterrupted power supply
- Instruments for Input/output voltage, current and frequency
- Alarms on the panel front

13.5.6 DC distribution boards

A) 220V DC

The distribution board shall consist of sectionalised bus with motorized tie breaker and each section of bus shall have one incoming disconnecting motorized MCCB, sufficient nos. of outgoing MCCBs of suitable capacity, as per Single Line Diagram and system requirement, automatically controlled heating element and all necessary control, protection and supervision instruments. Each board shall have at least 20% installed spare feeders with minimum one of each type in use.

B) 48V DC

The distribution board shall form part of the same panel in which 220 V to 48 V DC/DC converter is housed and shall have one incoming disconnecting MCCB, sufficient nos. of outgoing MCCBs of suitable capacity,as per Single Line Diagram and system requirement, automatically controlled heating element and all necessary control, protection and supervision instruments. The board shall have at least 20% installed spare feeders with minimum one of each type in use. The location of 220 V/48 V Converter cum 48 V distribution panel shall be finalized during detail engineering.

13.5.7 Alarm and Indication

Necessary provision shall be made for alarm and indication of at least following group faults at local panel as well as provision for potential free contacts/communication ports for remote indication to SCADA:

i) Battery Faults
ii) Battery Fuse Blown
iii) Float Charger Fault
iv) Boost Charger Fault
v) Battery MCCB Status (Closed/Open/Trip)

vi) DCDB incoming /Tie motorized MCCB Status (Closed/Open/Trip)
vii) Inverter MCCB Status (Closed/Open/Trip)
viii) AC & DC Over voltage
ix) DC Under voltage
x) DC Ground Fault
xi) 220 V/48 V Converter failure

13.6 Drawings, Documents and Design Calculations

13.6.1 Design memorandum

The Contractor shall submit to Owner a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1- General Technical Requirements.”

13.6.2 Drawings and documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 - Technical Documents” of “General Technical Specification (GTS)”.

13.6.3 Design calculation

The Contractor shall submit the design calculation in accordance to Clause 2.6 of “General Technical Specification (GTS)” covering at least the following, for review / acceptance.

i) Calculations of the DC power consumption during standstill of the generator units, during start, operation and shut-down of one generator unit, taking into consideration that the floating charge voltage of cell is maintained

ii) Calculations for capacity of the batteries

iii) Calculations for ratings/ capacities of the battery chargers

iv) Calculations for capacity of the inverters

13.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 “Delivery, Installation and commissioning” of “Section 1 - General Technical Requirements.”

13.8 Spare Parts

Recommended spare parts shall be supplied in accordance to clause 1.8 “Spare Parts” of “Section 1 - General Technical Requirements”. Specified spare parts to be supplied under this section are as follows:

S. No.	Description	Quantity	
A) BATTERY			
1.	Battery Cells	6 Nos. for 220V	
2.	i) Vent Plugs of each type ii) Caps of each type iii) Connecting Bolts/ Connectors of each type used	10 Nos. each 10 Nos. each 10 Nos. each	
3.	Inter cell connectors	20 Nos. for 220V	
4.	Electrolyte	10% of used quantity	
B) DISTRIBUTION BOARD FOR 220 V DC AND CONVERTER CUM DISTRIBUTION BOARD FOR 48 V DC		**220V DC**	**48V DC**
1.	Indicating Lamps of each type used	4 Nos. each	2 Nos. each
2.	Contactor of each type used	1 No. each	1 No. each
3.	Relay of each type used	1 No. each	1 No. each
4.	Indicating instruments of each type used	1 No. each	1 No. each
5.	Circuit Breaker of each type used	1 No. each	1 No. each
6.	220 V to 48 V Converter	NA	1 No.
C) BATTERY CHARGER(IF SCR BASED SYSTEM IS SUPPLIED)		**220V**	
1.	Indicating instruments	2 Nos. of each type used	
2.	Shunt Resistor	2 Nos. of each type used	
3.	Thyristor module along with heat sink	4 Nos. of each type used	
4.	Printed Circuit Cards	2 Nos. of each type used	
5.	Semi Conducting Type Fast Fuse	6 Nos. of each type used	
6.	Auxiliary Fuse	4 Nos. of each type used	
7.	Control Transformer	2 Nos. of each type used	
BATTERY CHARGER(IF SMPS BASED SYSTEM IS SUPPLIED)			
8.	Rectifier Module	01 Nos. of each type used	

9.	Card of each Type including charger controller	02 Nos. of each type used
10.	Control Fuses	04 Nos. of each type used
D) INVERTER		
1.	Circuit Breaker	2 Nos. of each type used
2.	Thyristor/IGBT module along with heat sink	2 Nos.
3.	Printed Circuit Cards – Inverter Control Card and Data Logger Card	2 Nos. of each type used
4.	Cooling Fan	2 Nos.

13.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 “Tools and Instruments” of “Section 1 - General Technical Requirements”.

13.9.1 Special tools

The Contractor shall propose the list of special tools including their make and detailed specification as recommended by manufacturer(s), to be accepted by the Owner.

The proposed list of special tools must include the following in addition to tools recommended by manufacturer(s)

i) Two (2) nos. of lifting device for battery cells of each type,

ii) Two(2) nos. Digital hydrometer

iii) Two (2) nos. cell testing voltmeter,

iv) Three (3) sets of apron, safety gloves, goggles and other safety items for handling of batteries

v) Emergency Eye wash Station made of Stainless Steel Material with Epoxy Coating

13.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements specified separately in “Quality assurance and Testing Specifications (QT

14 CONTROL AND MONITORING SYSTEM

14.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of employer's personnel, handing over to employer, availability of expert at site for one year and guarantee for two years of control and monitoring system as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

14.1.1 Local control boards

The Computerized Control and Monitoring System shall contain at least the following Local Control Boards:

i) Two (2) sets of Unit Control Boards (UCB) with all necessary accessories,

ii) One (1) set of LCB for Common Station Services One (1) set of LCB for Electrical Power Supply Service Boards with all necessary accessories for complete 11kV switchgear & feeders, DG sets, Unit Tap-off Transformers, 11/0.415kV SSTs, and 415 V switchgears. ,

iii) One (1) set of LCB for 420 kV GIS Control Boards with all necessary accessories.

14.1.2 Central Control Centre

Central Control Centre shall comprise of the following equipment:

i) Two (2) Operator Workstations each with two sets of 26" LED backlit monitors and all necessary accessories and software,

ii) One (1) Fixed Engineering station with all necessary accessories and software,

iii) One (1) Portable Engineering station with printer, all necessary accessories and software,

iv) One (1) Portable Operator Workstation all necessary accessories and software,

v) Large Screen LED wall Display size 162" diagonal with industrial Grade Video wall graphic controller, Video wall control PC acting as a video mimic,

vi) Emergency shutdown systems one for each individual unit,

vii) One (1) Emergency shutdown system for the entire station

viii) DELETED

ix) One (1) set of router/gateway with necessary hardware firewall functionality for Data transmission to Regional Load Despatch Centre, for monitoring. There shall be two ports and all the required data for LDC shall be available at both the ports so that data can be transmitted to dispatch centre through redundant channel.

x) One (1) set of router/gateway with necessary hardware firewall functionality, interfaces, accessories and terminal units for Data transmission to Administrative Building at Colony through ADSS optical fibre cable.

xi) PC based historical data storage system comprising of redundant workstation computers/servers of adequate capacity (one main + one hot standby) and redundant Network Attached Storage (NAS) for archival and retrieval of plant data.

xii) One (1) Training simulator, with all necessary accessories, software along with at least 5 user licenses, implemented on separate workstations and connected to the Central Control Room Network.

xiii) Operating desks for Engineering Stations, Data Storage system, and Operator Workstations along with 8 nos. chairs,

xiv) Control room furniture as per clause no. 14.5.17.

xv) One (1) set of RTM interface workstation with necessary software ,hardware ,firewall, interfaces, accessories and terminal units for Data transmission to Central Control Room at Corporate through optical fibre cable.

xvi) One (1) Operator Workstations each with two sets of 26" LED backlit monitors and all necessary accessories and software for installation at Uri I Stage I Power Station for operation of Uri I Stage II Power Station,

14.1.3 Process control networks & Power house LAN

i) Power House LAN with all necessary accessories and interfaces,

ii) Central Control Room Network with all necessary accessories and interfaces,

iii) Fibre optic Plant Control Network with all necessary accessories and interfaces,

iv) Six (6) Plant Computers, Two (2) servers and Two (2) printers with all necessary accessories and software hooked up with 1Gbps Power House LAN.

v) Tables for computers and printers along with 8 nos. Chairs

vi) One (1) Computer and One (1) atleast 65" smart HD-LED TV (to be installed at Administrative Buildings in colony) with all

necessary accessories and software connected with Power House LAN through ADSS optical fibre cable.

14.1.4 Link between Uri I & Uri I Stage II Power Houses

i) OFC Terminal Equipment for both the ends. The link has been envisaged through two ADSS Fiber optic cables, each of 12 cores to be laid between Power House of Uri I Stage I & Uri I Stage II including supply of necessary pipes for laying.

ii) One (1) set of workstation to be commissioned at Uri I Stage I for the remote operation and control of Uri I Stage II HEP with all necessary accessories including UPS.

14.1.5 All Dielectric Self Supporting (ADSS) optical fibre cable

All Dielectric Self Supporting (ADSS) optical fibre link shall be provided for connection between Power house and administrative building in colony. The details of route / arrangements shall be finalised during detail engineering.

The link shall be complete in all respects, comprising but not limited to following:

a) ADSS cable (minimum 12 core).

b) RTU equipment / optical modem and all necessary accessories including UPS, interfacing equipment etc, for real-time dual-window single mode (DWSM) communication between above locations.

c) All allied works for erection of ADSS cable, as required.

Steel Poles (if any required) for laying of ADSS cable shall be supplied and erected by the Employer.

14.1.6 Software

i) Supply of all necessary software as per the clause "Design and Construction" of this section and with their perpetual license for use that are specific for this project,

ii) Necessary routers and firewalls to prevent unauthorized access of process control networks from LAN / WAN connections including Power House LAN.

14.1.7 Time synchronization

Universal time synchronization system complete with redundant master clocks, at least ten (10) nos. of slave clocks, antenna and any other instrumentation / provisions required for time synchronization of all the equipment of the control system as well as protection system equipment, with Global Positioning System (GPS), so that each piece of equipment shall be synchronized individually. 'Output available at GPS system shall be IRIG-B, PPM, PPS and SNTP etc. in addition to output for CMR time synchronisation. Necessary multiplexing hub, interconnecting cables, power supply etc. shall be deemed inclusive.

14.1.8 Interfacing services and supply

Coordination, supply of associated interfaces including transducers and integration of all plant equipment and subsystems including all auxiliaries and station services with the computerized control and monitoring (SCADA) system for complete control, real-time communication and data acquisition. SCADA system and other online processing & measuring equipment shall be provided with suitable rating of Class C type Surge protection devices/ better devices. Surge arrester shall be tested as per IEC 61643-1. The surge arrester shall be pluggable type and shall have indication facility to indicate its health. However any proven method of surge protection shall also be acceptable subject to approval by the employer.

14.1.9 Miscellaneous items

i) One set of RADAR based measuring devices/ sensors for measurement of Tail Water Level and cabling from such devices/ sensors to Central Control Room.

ii) Printers and plotters as below:

a) Colour Alarm printer,

b) Event and data logging colour printer,

c) A3 size colour laser printer

d) Two heavy duty A3 size black & white laser printers

e) High quality colour plotter (A0 size)

iii) Availability of expert(s) for one year from date of commissioning of last unit to ensure applicability of clause no 14.4.1.

iv) Spare parts in accordance to clause 14.8 "Spare Parts" of this section.

v) Tools and instruments in accordance to clause 14.9 "Tools and Instruments" of this section

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

14.1.10 Synchronous condenser operation

Control and monitoring (SCADA) system shall be designed for Synchronous condenser mode.

The control logics of UCB shall be designed suitably for successful synchronous condenser mode operation of units from control room and switching over between generating/excitation/condenser mode. All the instrumentation required in synchronous condenser mode operation shall be interfaced with SCADA system for smooth functioning.

14.1.11 Cyber Security

The Contractor shall strictly adhere to following cardinal principles while designing the cyber security framework for SCADA and associated system

i) The SCADA and associated Systems shall be hard isolated from any internet facing IT system. Provision of Downloading/Uploading of any data/information from the internet facing IT system will only be done through an identifiable whitelisted device followed by scanning of both for any vulnerability/malware as per the SOP laid down and provision of maintenance of digital logs for all such activities

ii) Listing of whitelisted IP addresses for each firewall shall done and each firewall shall be configured for allowing communication with the whitelisted IP addresses only.

iii) Provision of communication between OT equipment/systems is done through the secure channel. Security configuration of the communication channel shall be ensured.

iv) All ICT based equipment / system deployed in infrastructure/system mandatorily shall be sourced from the list of the "Trusted Sources".

v) The network equipment shall have a high level of security features in order to prevent any kind of external intrusion/ hacking event into the system. The security parameter shall include port security, both multiple IP and multiple MAC addresses, blocking the unused port, disabling/enabling of web manager and telnet. The system shall be free of all kind of bugs, viruses, malware etc. and customize as per NHPC"s requirement.

14.2 Specific Parameters and Layout Conditions

14.2.1 Layout and General Arrangement

The basic configuration, network topology and general layout of the control system shall be as per drawing NH/DEM/ URI I STG II /CP/02 of control and monitoring system. However, equivalent or better Network topology ensuring redundancy of network media, switches and servers etc. will also be accepted, if proven better during detail engineering.

All UCB and LCB panels shall be based on IP 52 class of protection for enclosure.

The control and monitoring system shall be built up of distributed and independent control modules in hierarchical control levels. All the components and subsystems in the hierarchical control levels of the control system shall be seamlessly integrated to achieve a highly reliable and scalable power plant control system.

The overall control shall be affected from the Central Control Room. Provision shall be made to adopt the control system for future remote monitoring from a Remote Control Centre. The highest control level shall be the Operator Workstations in the Central Control Room (CCR). From

the Operator Workstations, the operator shall have the possibility to perform in real-time, controls and adjustments for all the equipment of the scheme. One (1) Computer and one (1) No. smart HD-LED TV at least 65" shall be installed at Administrative Building in Colony for monitoring only. All the computers, peripherals, software, actuators, sensors, measuring instruments and other hardware shall be of latest state of the art at the time of supply and compliant to CEA cyber security guidelines. If the control system mentioned in the awarded contract becomes obsolete at the time of supply, the Contractor shall offer a latest model.

The control system should be built in such a way that in case of a fault in any single equipment others are not affected and system continues to function effectively. Feedbacks and communication interfacing shall be designed in such a way that ,in case ,GIS LCB goes into fault while respective bay LCCs are healthy ,tripping of generating units/lines shall not be initiated rather an alarm indicating loss of GIS LCB shall be generated.

The control system shall be designed on open standards based on IEC 60870-5 series and Object Linking and Embedding for process control (OPC) standards. Control & Monitoring System design should be robust to address the high humidity, high temperature variations and importance should be given while selecting the field instrumentations. The communication between electrical protection system and their respective LCB / UCB shall be based on IEC 61850.

The control and monitoring system and the components shall be selected taking the following requirements into consideration:

i) Reliability of components and subsystems,

ii) Scalability of the system for future extensions,

iii) Backward compatibility and Interoperability with other sub-systems including multi-vendor platforms

iv) Availability of spares,

v) Ease of maintenance,

vi) Service availability and adaptability for future technology developments,

Separate hardwired relay logic shall be provided in UCB for shutdown (except that of Electrical protection for which hardwired logic is already in place at GRP) as per tripping matrix provided during detail engineering, This logic shall be completely independent of microprocessor system and shutdown / Trip commands shall be given directly from relay logic to key devices like mastertrip relay governor, MIV, brakes etc..As a backup control, the same relay logic shall be duplicated as logic in controller and shall issue the tripping command to master trip relays and to other devises. However, for key devises like MIV,field breaker etc. the hardwired interlock(viz. seal feedback for MIV and GCB feedback for field breaker etc.) must be fulfilled. The hard wired and software logic shall be there for :

- Operation of Emergency shutdown relay in Generator protection panel
- Emergency stop PB on UCBs

- Emergency stop PB on the operator control desk in Control room
- Operation of Control Action Shutdown relay
- Operation of partial shutdown and bring the unit in spin/ excited state.The matrix for partial shutdown shall be finalized during detail engineering.

PC based historian station and Redundant Network Attached Storage (NAS) device shall be provided for automatic backup & archival of online process data.

Details of Protection system shall be as per section "Protection system" of PTS, however, all the protection signals originating from mechanical protection devices like RTD/TSD, flow meters, pressure sensors, Buchholz relay etc. should be hardwired to the respective UCB / LCB and master trip relay for generation of necessary alarms, events and tripping. Mechanical protection device such as TSDs shall ~~in have 4-20 mA output in addition to~~ local dial and potential free contacts for alarm and tripping.

All the control system equipment including UCBs, LCBs, Data loggers & retrieval System, routers, serial & digital interfaces of communication network Ethernet switches, power supply cards, I/O module connections and other external interfaces should have suitable rating of surge protection device at functional level. Surge protection devices for AC & DC supply of UCBs/ LCBs/ RTU shall be of pluggable type. The surge protection device shall be tested with IEC 61643-1.The surge arrester should have failure indication facility.

The architectural finishing work, i.e., suspended ceiling, suspended floor, furniture, wall finishing required for the Central Control Room etc., has to be intimated by the Contractor according to his requirement for subsequent execution by civil Contractor

14.2.2 Control Philosophy

There shall be four levels of control & monitoring with suitable interlock mechanism to ensure that only one control level is active at particular time. However, even if a unit is started from drive control level and after achieving a stable state the selection is either changed to UCB level or Control room level, the software sequence(either automatic or step by step) should be capable to carry from that state onwards if a command is given from the selected level.

A) Level 1 (Drive control)

Lowest level control shall be from local control panels / starter panels of respective equipment of auxiliary system (supplied by respective auxiliary system suppliers). These panels shall have provision for local, remote, manual & auto operation. If selected for remote operation, the panels will get commands (either Auto or manual) from respective UCB's / LCB's, whereas in local operation, commands can be given from the local panel itself with necessary safety interlocks.

(B) Level 2 (UCBs/ LCBs)

The next higher level control shall be from Control boards installed at machine floor / other locations of power house complex.

Level 2 control of individual units shall be from Unit control boards (UCBs) comprising of automatic sequence control equipment, local HMI computer with facility for individual drive operation, alarm annunciation system, for comprehensive view of the operating parameters of the plant.

Level 2 control of ancillary system shall be from the following Local Control boards (LCBs):-

- Local Control Board (LCB) for Common & station services - for control & monitoring of common & station services and Dam monitoring board. with all necessary accessories.
- Local Control Board (LCB) for Electrical Power supply service boards :- for control & monitoring of electrical power supply services with all necessary accessories for complete 11 kV switchgears & feeders, DG sets, Station Auxiliary Transformers, Unit Auxiliary Transformers, SSTs and 415 V switchgear etc.
- Local control board (LCB) for GIS:- for control & monitoring of 400 kV GIS system, Bus reactor etc.

C) Level 3 (Central Control Room)

The overall control (highest level) shall be from the "Operator Workstations" installed in the Central Control Room (CCR) at Power house, which shall be the highest control level. This station shall facilitate the operator to perform in real-time, controls and adjustments for all the equipment of the scheme. The system shall meet the requirements of remote controls of the powerhouse & ancillary plant areas and shall be suitable for manual / automatic start-up, running, normal/ emergency shut-down of the generating units, control & monitoring operation of the station auxiliary systems & other sub-systems.

The system consists of reliable PC based Operator workstations, PC based engineering stations, PC based historian station, network attached storage devices (NAS), large video display unit, routers / gateways and printer units at the control room level.

D) Level 4 (Remote Location)

Router / gateway with necessary hardware firewall functionality including DMZ as per IEC 62443, other interfaces and accessories shall be provided for operation and control of entire power plant from remote control centre with following remote SCADA locations:-

i) Two–way real time exchange of data, logic and analog variables commands and set points with RCC / other location of NHPC through VSAT network / MPLS based Leased line.

ii) Two–way real time exchange of data, logic and analog variables commands and set points with administrative building of Uri I Stage II H. E. Project through optical fibre link

iii) Monitoring from Regional Load Despatch Centre through PLCC/OPGW

iv) Automatic Generation Control from NLDC at IEC 60870-5-104 through OPGW terminal equipment. OPGW terminal equipment will be in scope of Employer.

It shall be the responsibility of the contractor to provide and install necessary routers/gateways with firewall, interfacing and other accessories for remote operation, control and monitoring with robust cyber security framework. The communication protocol for remote monitoring, control & operation shall be OPC-UA/ Modbus/ TCP-IP. The gateway should accept binary commands and analog set points from remote control centre (RCC) for control and operation of entire power plant. However, final selection of protocol shall be made at the time of detailed engineering.

As standard implementation, power house control room should always be the master with RCC being in monitoring mode. When power house control room allows remote operation from the RCC, the mode should change from monitoring to Control & Operation at the RCC. When RCC is in Control & Operation mode, the same shall be displayed in the mimics at the power house control room (CCR).

It will be the responsibility of contractor to provide implementation profile during detailed engineering for examining the interfacing with RCC corporate monitoring system and RLDC for compatibility of data transmission and final integration of specified plant data. The communication protocol for gateway to RLDC shall support IEC 60870-5-104 for all levels. Two ports on IEC-104 protocol shall be provided for data transmission to RCC/ corporate monitoring centre and load despatch centre. Protocol gateway specifications shall be decided during detailed engineering.

Communication to RCC/ corporate office shall be through Employer's CUG (Closed User Group) network. The dedicated bandwidth VSAT / Leased line communication forming part of Employer's network shall be provided by the Employer for data transmission & communication between power house control room and RCC/ corporate office control room. The VSAT link shall be a SCPC PAMA link and Leased line shall be MPLS based network.

The interfaces on the router to which VSAT / Leased line IDU shall be connected should be serial WAN interface catering to speed of at least 2 MBPS or higher for which technology is commercially available at the time of supply. The Contractor shall perform network testing in order to demonstrate all the network features desired.

14.2.3 Networking and communications

The network shall consist of two main networks namely "Process network" and "Control room (SCADA) network" which shall be further extended to Power house LAN through suitable hardware firewall. All networks including Power House LAN shall be redundant. All RTU data communications shall be encrypted.

The networks shall be configured using media, servers, routers and switches to achieve high operational availabilities for top order events. The system availability shall analyse and calculations shall focus on availability of the control system for the top order event like retrieving all

process data from UCBs / LCBs, operate all breakers and shut down all units. The overall system unavailability shall be computed by considering individual device unavailability in a fault tree analysis using MTTR, MTTF and MTBF values of each device as supplied by its manufacturer.

All the optical fibre cabling within the power house shall be armoured type suitable for laying directly on the cable trays. All redundant cables shall be physically routed along different paths so as to ensure higher availabilities. The networks shall be designed for 1Gbps, real time and full duplex (bi-directional) communications.

For the purpose of remote monitoring of reservoir level,dam site equipment and Power house data of Uri I Stage I, all interfaces and accessories shall be provided for dual window single mode optical fibre link between Power House of Uri I Stage I and Uri I Stage II. The link shall be suitable for voice and data communications also.

14.2.3.1 Process Network

The main function of the process network is to connect various DCS (LCBs, UCBs etc.) stations together to form an integrated plant control system. The main task of the network shall be to connect process control stations reliably together. The network shall be based on Optical fibre and use of open protocol.

The Process network shall be connected to the control room (SCADA) network through redundant fibre optic Plant Control Network via managed Ethernet switches. The bus systems shall be self-monitoring type. The main characteristics of the bus system shall be as follows:

i) The bus-systems shall be physically redundant installed on different routes,

ii) Both the systems shall operate separately and in case of traffic interruption on one bus, the other shall take over the traffic. By this principle all bus couplers, bus interfaces etc. shall be coupled with one active and one stand-by device forming a complete system,

iii) Real time, full duplex data transmission rate, of at least 1Giga Bytes per second shall be provided,

iv) Interfaces shall be according to relevant IEC standards.

14.2.3.2 Control Room (SCADA) Network

Control room network shall be used in the control room to link the PC based Operator stations, PC based engineering stations, PC based historian stations, Network attached storage devices (NAS), large video display units and other peripherals in control room, such as, printers, redundant GPS clock, routers, gateways, network elements etc. and shall ensures that the control room equipment communicates internally as well as with the various DCS stations connected to the process network. The redundant network shall be based on ETHERNET standard with TCP/IP protocol having 1GBPS data transfer rate for fast and reliable data transmission.

The Control Room Network shall be extendable to remote SCADA centre as well as Power House LAN through gateway extensions with necessary routers & firewalls.

14.2.3.3 Power house LAN

The LAN network shall be used in control block area of the power house to connect the plant computers, plant servers and other peripherals. The LAN shall be connected to SCADA network through router / gateway with firewall to restrict unauthorized access of SCADA as well as process network data. The redundant network shall be based on ETHERNET standard with TCP/IP protocol having 1GBPS data transfer rate for fast and reliable data transmission.

The network shall be complete with Gigabit Ethernet LAN switches for at least 8 connections spread across the control block area of powerhouse, all necessary interfaces, routers for LAN / WAN connectivity, connectors and other accessories. Necessary Provision for extending the LAN in another area and interconnection with existing LAN, if any, shall also be provided.

14.2.3.4 Network Switches for Networking and communications

The network ethernet switches shall be selected taking following requirements into consideration:

1) The network switches shall be able to configure and diagnose via. SNMP (Simple Network Management Protocol), via.WBM (Web Based Management) and via. serial interface (Hyper Terminal).

2) The network switches shall have redundant power supply voltage connection, floating alarm contact, status and diagnostic indicators, pluggable and configurable parameterization memory, din rail mountable, auto-crossing, auto-negotiation as minimum acceptable features to ensure easy maintenance as and when required.

3) The network switches shall have Gigabit Ethernet on all ports.

4) The network switches shall be only Industrial Grade and in conformance with EMC directives in accordance with IEC 61000 with following parameters as below:

   i) Noise immunity in accordance with IEC 61000-4-2 (ESD)

   ii) Noise immunity in accordance with IEC 61000-4-3 (electromagnetic fields)

   iii) Noise immunity in accordance with IEC 61000-4-4 (Burst)

   iv) Noise immunity in accordance with IEC 61000-4-5 (Surge)

   v) Noise immunity in accordance with IEC 61000-4-6 (conducted)

5) The network Switches shall be in conformance with following Mechanical Tests as below:

   i) Shock test according to IEC 60068-2-27

   ii) Vibration resistance according to IEC 60068-2-27

   iii) Free fall according to IEC 60068-2-32

6) The fibre optic ports of the network switches shall be in SFP (Small Form Pluggable) format so that both multi-mode and single-mode glass fibres can be used as per transmission distances in the network.

14.2.3.5 Network Security

The network equipments shall have a high level of security features in order to prevent any kind of external intrusion/hacking event into the system. The security parameter shall include port security, both Multiple IP and Multiple MAC addresses, blocking of unused port, disabling/enabling of Web manager and Telnet, Multilevel user password to secure the switch and alarming or warning system in case of fault in the network.

The network equipment hardware firewalls, routers, etc. shall be electronically secured and compliant to IEC 62443/NERC-CIP guidelines.

14.2.4 Interoperability

The complete design of the computerized control and monitoring system shall be based on interoperability of equipment from different manufacturers and the Contractor shall be responsible for overall functional integration of the system. The control system shall be implemented on open standards based on Object oriented design.

It shall be the responsibility of the Contractor to verify and solve all interoperability issues of various components / equipment connected to the network. The Contractor shall perform a type conformance test to validate the implementation of the communication protocols.

14.2.5 Redundancy

The control system shall have both physical and functional or operational redundancies. All the control system should have suitable rating of surge protection device at functional level. These arresters should have fault indication facility to indicate its health. At least the following physical redundancies shall be ensured in the design of the control and monitoring system:

i) Redundancy of communication media shall be through redundant optical fibre cables.

ii) Operator station redundancy shall be ensured by mirror images of process data on all the two operator workstations.

iii) Networking redundancy shall be implemented by using redundancy of the media, servers, routers and switches. All networks including Power House LAN shall be redundant.

iv) All Controllers and their power supply distribution cards used in LCBs/UCBs shall be redundant.

v) Event and Alarm printers shall be configured to take-over the duties of each other in the event of failure of any one of them,

vi) The unit shut down system shall include emergency shutdown system implemented by hard wired logic.

vii) The database storage system shall be redundant and implemented through PC based historical data storage stations and Network attached storage (NAS).

viii) The GPS synchronization master clocks shall be redundant.

14.3 Rating and Functional Characteristics

14.3.1 Topology, redundancy and availability

The networks shall be configured using redundancy of media, servers, routers and switches to achieve high operational availabilities for top order events. The system availability shall analyse and calculations shall focus on availability of the control system for the top order event: "Availability to retrieve all process data from LCBs and operate all breakers and shut down all units". The overall system unavailability shall be computed by considering individual device unavailability in a fault tree analysis using MTTR, MTTF and MTBF values of each device as supplied by its manufacturer.

14.3.2 Decentralised Control

The instrumentation and control system shall be based on the decentralized intelligence system, which means that Controllers of the corresponding system operates the logic and control functions.

The control system shall be divided into discrete functional subsystems. Each sub-system shall be controlled from its Local Control Board if the "LOCAL" position is selected. The Local Control Board of each system includes redundant power supply distribution, interfacing terminals with the process, redundant controllers and HMI. Each Local Control Board shall have provisions and interfaces for direct connection of mobile engineering stations.

The Unit control Board and Local control board must be provided with surge protection device .The surge protection device shall be tested with IEC 61643-1 .The surge arrester should have failure indication facility to indicate its health.

Generating units (Unit Control Boards) shall, in addition to the above, consist of automatic and manual synchronizers. However the Local Control Boards associated with switchyards shall have manual synchronizer only.

14.3.3 Computers and peripherals

Computers used in the control and monitoring system shall preferably be of a standardized type suitable for industrial environments and of a brand approved by the Employer. The signal transmission shall be via redundant cables. All monitors shall be of Full HD resolution, flicker free LED backlit type with at least 26" screen size. All Computers, printers, keyboards and other accessories supplied shall be of standardized type suitable for Hydro power plant environmental conditions

14.3.4 Power supply for Local Control Boards

Each LCBs and UCBs shall be fed from two independent 220V DC supply for control functions. These two supply shall be from two different DC supply source. One power supply shall be main and other standby. In case of failure of main supply, standby supply shall be switched on automatically.

Power supply converters / units /modules provided in the UCBs / LCBs shall be 100% redundant. In case A.C. supply is used for any control function, two on-line station UPS, with one as standby, powered by 220 V DC system shall be provided.

Both the AC and DC Power supply inputs for the local control boards shall be protected at the input by Class C type Surge Protection Devices.

The power supply distribution should be designed in such a way that the intermixing of power supply of different levels in the field circuit of any particular I/O channel should not harm/damage the complete I/O card / controller unit etc. but should be restricted to particular I/O channel only.

14.3.5 Programmable controllers for LCBs and UCBs

The programmable controllers / PLCs to be supplied shall be modular in architecture and microprocessor based design suitable for harsh industrial environments. All power supply cards, I/O module consisting of DI/DO, AI/AO.Pt 100 temp sensor card connections and other external interfaces shall be provided with suitable surge protection or better devices to protect the controllers and internal circuitry from external surges. The surge arrester should be tested as per IEC 61643.The Surge arrester should have failure indication facility to indicate its health. All power supply cards, I/O module connections and other external interfaces shall be provided with suitable DIN rail mountable surge protection devices in accordance with IEC 61643 test standards to protect the controllers and internal circuitry from external surges. Unless otherwise specified, the equipment shall be in compliance with IEC 61131 standard. From cyber security point of view, controllers shall also be in compliance with IEC 62443/NERC-CIP guidelines.

All PLC units used in the control and monitoring system shall be of the same manufacturer and of the same model. The processor module should be hot swappable redundant with bump less transfer facility. The controller switchover shall be within 10 ms. Program loading/modification in any of the controller shall be automatically copied to the redundant counterpart. Interchangeability and inter-operability of PLCs used shall be established by the Contractor.

The supply for PLC shall include all equipment and services for operating and maintenance, such as manufacturer's standard firmware, licensed PLC programming and debugging tools, test equipment, all software with license for use and source codes for the application programs, spare parts and full documentation along with training. Each PLC shall have long-life internal battery backup/ non-volatile memory for storing running data and programs. All software and firmware supplied must be of latest release/ version. The processor offered for PLC should not be less than 32 bit. The processor speed should not be less than 200 MHz. Minimum RAM capacity shall be 256 MB.

The process of DCS shall be designed in such a way that at any time, the processor utilization (CPU load) shall not be more than 50%.

For each output a safe position shall be defined for cases of failure of power supply, output module, CPU, etc. This safe position shall be clearly defined by the Contractor and submitted to the Employer. Each controller shall have built-in functions of on-line self diagnostics / watch dog features etc and shall report failures to the operators of the control system. The CPU shall be able to accept external time synchronization from GPS system, adjust its internal clock with the time synchronization system and then time tag data with an absolute clock.

Each I/O of (DI/DO, AI/AO.Pt 100 temp sensor card) point of the controllers shall be supplied in standard rack-mounted I/O modules with plug-in boards. Each I/O point shall be furnished with:

i) Protective network, such as surge protections, optical coupling and/or other isolating barriers,

ii) Filter for noise reduction,

iii) Test points and fault indication lamps,

iv) Fuse protection and fuse failure detection.

v) The I/O module shall be hot swappable.

vi) Integrated SOE from the same DCS family shall be provided.

14.3.6 Emergency shut down

Emergency shutdown equipment shall be implemented through hardwired logic using Safety Relays (SIL-3, IEC61508).. Emergency shutdown shall be initiated by the monitoring and protection devices as well as by manual release of the emergency shutdown buttons to be provided in the UCB and Central Control Room. The timing of emergency shutdown and associated closure devices shall be adjusted according to the hydraulic requirements of the system.

14.3.7 Metering

For monitoring the generation and transmission of power, a metering system using digital meters shall be provided for all lines and feeders of GIS / Pot yard, Generators at 13.8 kV level, all lines and feeders of 11kV levels, Unit Tap off Transformers, ~~Unit auxiliary transformers~~, Station Service Transformers, Excitation Transformers and DG Sets. All measurements such as voltage, current, power, energy etc., used for monitoring, shall be provided as per drawings. All the energy meters used for measurements shall have minimum accuracy of 0.2S and shall be connected to the data acquisition system for automatic meter readings. The special energy meters (SEMs), as marked in the drawing, are used for commercial purpose and hence shall be provided by load dispatch agency and only their CT cores, wiring up to GIS Local Control Board & providing enough space for installation are included in this contract. However, Special Energy Meters (SEMs) to be installed at 13.8kV side of each unit shall be in the scope of supply. The Special Energy Meters (SEMs) shall have the following features:

i) Meters shall be static type and have anti-tampering features.

ii) Meters shall be capable of four quadrant measurement of kWh, kVARh, kVAh.

iii) Meters shall have downloading facilities of metered data through meter reading instrument (MRI).

iv) Meters shall be immune to external influences like magnetic induction, vibration, electrostatic discharge, switching transients, surge voltages, oblique suspension and harmonics etc.

v) Meters shall have necessary ports for communication to plant SCADA system.

vi) Communication Cables for the transfer of all SEM data to plant computers in control room shall be provided.

vii) Meters shall meet all the requirement of latest regulation at the time of commissioning.

14.3.8 Time resolution of events

Resolution of dating of events for purposes of sequence of event recording shall be of 1milli second.

14.4 Performance Guarantee

The computerized control and monitoring system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. It is the responsibility of the Contractor to supply the equipment as per guaranteed technical particulars and shall also guarantee the reliability and performance.

The control and monitoring system shall be fault tolerant with redundancies at all levels as specified in the sub clause "Redundancy" of clause 14.2 "Specific Parameters and Layout Conditions".

The control system shall have fail safe features so that even in case of failure of all redundant controllers, the outputs shall be latched on to a safe value that ensure minimum plant safety features. The Contractor shall identify and submit to the Employer a detailed list of these fail safe outputs along with their safe values during detailed engineering.

Real time, full duplex data transmission rate, of at least 1Gbps shall be provided. The availability of 1 Gbps data channel between two remote stations shall be greater than 99.99% and shall be guaranteed.

The Overall control and monitoring (SCADA) system availability for top order events shall be at least 99.98% after 45 days from date of commissioning of last unit and shall be guaranteed. 45 days period shall be treated as period for teething problems/setting of software and stabilization. The control system shall be guaranteed against interoperability with all the power house equipment and shall comply with IEC 60870-5 series. System shall be guaranteed for order response time of less than or equal to 20-500 milliseconds.

14.4.1 Penalty

During the period of availability of expert as defined in Clause 14.1.10. (iii) penalty shall be imposed for every incidence of fault related to control, monitoring and SCADA if not attended within 3 hours after occurrence of the fault specifically for running of each unit. The record of such incidences after 45 days from commissioning of each unit shall be maintained by the project. An amount equal to 0.01% for each event of each unit subject to maximum of 0.5% of contract value shall be levied as penalty.

14.5 Design and Construction

14.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S. No.	Standard	Description
1	IEC 60255	Electrical relays
2	IEC 60297	Dimension of mechanical structure of 19 inch series
3	IEC 62326	Printed Boards
4	IEC 60445	Basic and safety principles for man-machine interface, marking and identification, identification of conductors by colours or numerals
5	IEC 61204	Stabilized power supplies, DC output
6	IEC 60488	Interface system for programmable measuring instruments
7	IEC 61000	Electromagnetic compatibility for industrial process – measurement and control equipment
8	IEC 61131	Programmable Controllers
9	IEC 61499	Function blocks
10	IEC 61158	Digital data communications for measurement and control – Field bus for use in industrial control systems
11	ISO/IEC 8802	Information technology
12	IEEE 1046	Application guide for distributed digital control and monitoring for power stations
13	IEC 60870	Tele-control equipment and systems

S. No.	Standard	Description
14	IEC 60793 Part 1	Optical Fibre- Measurement and test procedures
15	IEC 60793 Part 2	Optical Fibre- Product specifications
16	IEEE 802.1W	Network Switches in Communication Networks and Systems for Power plants
17	IEC 61850	Communication Networks & Systems in Substations
18	IEC 61643-1	Surge Protection Devices
19	IEC 62443	Implementation of electronically secured industrial control and automation systems.
20	NERC-CIP Guidelines	North American Electricity Reliability Corporation Critical Infrastructure Protection guidelines.
21	IEC 62682	Management of alarms systems for the process industries.
22	CEA	CEA (Cyber Security in Power Sector) Guidelines , 2021

Optical Fibre Cables used shall comply with the provisions of latest ITU-T Specifications and IEC standards. The communications and networks of the control system shall be implemented on open network standards conforming to IEC 60870-5 series standards. Any design feature or detail not specified herein shall be in accordance with the above-mentioned standards, which shall supplement these specifications.

All the mimic views, software, printouts, documentation symbols, reports, labels etc. shall be in English language only.

To achieve redundancy and operational centralization, a Central Control Room shall be implemented from where all units along with all their unit auxiliaries, all Station Services, all Common Services, all GIS and electrical power supply distribution shall be operated and supervised.

14.5.2 General

The designed control and monitoring system shall be common state of art at the time of supply. This specification requires that all local and remote control systems in the power house and the ancillary plant areas shall be suitable for manual and automatic start-up, running and normal and emergency shut-down of the generating units and the station auxiliary systems. Redundant Controllers of latest microprocessor based design with high processing speeds and solid-state electronic elements shall accomplish the control.

The DCS shall have an open architecture and shall be able to interface with other communication protocols like IEC 61850, SNTP, IEC 60750-5-105, RS485, Modbus TCP-IP, OPC-UA etc for interfacing with other system.

14.5.3 System configuration

The basic system configuration shall be as per approved scheme based on Employer's drawings. The normal turbine-generator start-up and shutdown shall be controlled automatically either from the Unit Control Boards on the machine hall floor or from the Operator Workstations in the Central Control room. Manual control shall be possible from the Unit Control Boards.

The control system logics designed for unit operating sequence shall have the following stable states.

- Unit in standstill
- Unit in SNL (speed no load without excitation)
- Unit in SNLE (speed no load with excitation)
- Unit in generating mode
- Unit in SNLE mode from generating mode
- Unit in SNLE mode from generating mode during tripping of all lines
- Unit in Synchronous condenser mode
- Normal shutdown sequence
- Partial Shutdown
- Emergency shutdown
- Unit in line charging mode

The system shall be designed for trouble free transfer from one state to the other. Protections and other requirements during different states and transitions shall be automatically controlled.

According to the sequence of starting, all unit auxiliaries shall be automatically started prior to unit start-up; the generating units shall come up to speed and be automatically synchronized to the grid. On normal stop operation, the unit shall automatically be brought to no-load condition, the generator circuit breaker shall be tripped, excitation switched off and the mechanical brake applied.

The control system shall be furnished with necessary devices for local manual, local automatic and remote automatic control of the units. The design shall permit transfer from one mode of control to another without disturbing the operation of the units. All Local Control Boards including Unit Control Boards shall be provided with HMI panels for process visualization and control. Each Human Machine Interface shall:

1) Have station with colour tactile screen or equivalent,
2) Have screen size of at least 17" industrial LED panels of high resolution, with IP 65 class protection for front enclosure.
3) Have graphics supervision software,
4) Withstand to machine hall environment,
5) Connect directly to redundant CPU mechanism,

6) Display Mimic diagram views with control functions,

7) Maintain measurements and indications including running hours,

8) Maintain alarm and status indications,

9) Perform archival of events,

10) Display visualization of subsystem status,

11) Execute commands.

From the Local Control Board, the operator shall be able to access important information about the system, and initiate automatic, step-by-step or manual sequences to control the process. The main redundant controllers with redundant power supply cards shall be mounted on the Local Control Boards together with all the electrical protections, measurements and indications of all analog parameters, and Alarm/ Annunciation system. The communication between electrical protection system and their respective LCB/UCB shall be based on IEC 61850.

The system shall perform the following functions:

i) The system in addition to the above shall also continuously monitor Tail water levels and downstream discharges.

ii) Continuous monitoring for trash rack plugging conditions so as to raise necessary alarms.

iii) Speed control and load control through governor.

iv) Generation control based on reservoir level restrictions and Uri I Stage I generarion, Availability based tariff based restrictions, downstream release considerations and time based schedules.

v) Flow control: The flow control shall control the power output of the plant according to the water quantity available over a period.

vi) Parallel operation with integrated generating system.

vii) Joint control of all the four units.

viii) Facilities for Monitoring from corporate office control room and administrative building in colony

ix) Isolated operation on a selected grid.

x) Black-start, i.e. no external power source available, but only on the emergency diesel generators.

xi) Line charging Operation.

xii) Synchronous condenser operation

xiii) Automatic voltage regulation.

xiv) Machine loading with active and reactive power.

xv) Metering and recording of all characteristics of the turbine and generator operation including running hours.

xvi) Automatic backup of on-line process data using PC based historic data storage station..

xvii) Perform periodic permanent backups of process data on archival storage media (NAS) based.

xviii) Indication of normal operation of the auxiliaries that are essential for secure and reliable operation of the unit

xix) Audible and visual warning of dangerous / faulty operating conditions of the unit and / or essential auxiliaries.

xx) Audible and visual alarm and display of dangerous operation of the unit and the essential auxiliaries, or faults that may initiate tripping of the circuit breaker without stopping the unit.

xxi) Power supply and control of essential auxiliaries of each unit.

xxii) Video Mimic and indication labels on VDU.

xxiii) Automatic synchronization.

xxiv) Manual synchronization.

xxv) Manually operated covered push buttons for automatic safe shut down of units.

xxvi) Fault location: this function shall have a high accuracy. The fault location assessment shall be independent of fault resistance, load current or the supply of a data from different sources.

xxvii) Automatic station supply changeover.

xxviii) Interlocking of various equipment for safe operation.

xxix) Configuration tools: Easy to use interactive configuration tools shall customize the various functionalities. The configuration tools shall provide visual presentation of the object, adaptations needed in process database, and adaptations of the communication configuration data. These tools shall provide:

a) System configuration,

b) System testing,

c) Help functions,

d) Program documentation,

e) Down and up loading of programs,

f) System commissioning,

g) Real time distributed data base management,

h) Changing parameters.

14.5.4 Central Control Room

The architectural finishing work, i.e., suspended ceiling, suspended floor, furniture, wall finishing required for the Central Control Room etc., has to be intimated by the Contractor according to his requirement for subsequent execution by civil Contractor

14.5.4.1 Layout

In Central Control Room the following equipment shall be provided:

i) Operator workstations with video display units keyboards and pointing devices.

ii) Routers/gateways for communication between Power House & Corporate Monitoring centre, NLDC for automatic generation control, Regional Load Dispatch Centre, Dam RTU, and admin building in power station colony.

iii) All real time plant data shall be stored on high performance, high capacity redundant PC based storage system of minimum 4TB capacity or maximum available HDD capacity at the time of supply to store the plant historical data. The information stored by these storage appliances shall be available online with automatic "Hot" backup of online data and ready to share by clients and servers on the central control room network with powerhouse LAN.

In addition to above redundant NAS device on open system architecture to connect them to other vendor's equipments shall be used for archival and retrieval purpose. Each Network Attached Storage (NAS) system shall be of minimum 8TB or higher capacity.

iv) Colour Laser report printer

v) Colour laser high quality printer

vi) High quality plotter along with accessories

vii) Alarm laser printer and Event & data logging printer,

viii) Engineering station,

ix) Training Simulator station,

x) Necessary interfaces such as LAN switch for extending the Central Control Room Network to connect to Power House LAN and plant subsystems (e.g. Communication system etc),

xi) Portable engineering and operator stations,

xii) Provision for placing the VSAT/Leased line IDU in the control room.

The Central Control Room shall use latest high end, SCSI workstations based on latest version of Windows Networking operating system. Operator Workstations shall be configured so that in case of failure of one operator workstation, the other stations shall automatically takeover the control of the failed one without requiring any operator intervention. Such changeover shall be smooth and rapid without affecting the system that is being controlled. Necessary arrangements for maintaining mirror copies of process data on all operator workstations shall be provided.

All functions shall be accessible through the VDU and keyboards and also through a pointing device such as trackball, so that the operator never needs to take his eyes off the screen.

Basic functions of control and supervision of power plants shall be included in a standard software package. The functions shall be upgradeable by reprogramming through a standard programming language implemented in an Integrated Development Environment (IDE). The supply of IDE along with the programming language shall be included in the scope of supply. A library of functions related to hydro power plant control and operation shall be provided

The Central Control Room shall:

a) Provide acquisition of data inputs coming from the local controllers,

b) Process the data inputs in order to update its real time data base,

c) Process the data outputs to control the power plant,

d) Implement screen based video mimics made available on operator workstations, and engineering stations, The above shall be provided with all the necessary views that are required for a fully functional and complete system. Detailed listing of views, their design, look and feel etc, shall be approved by the Employer during detailed engineering.

e) One mimic of station overview including the all-important powerhouse unit, station and barrage data shall be prepared to display the data of Uri Power Station.

f) Printing reports (events and sequence of events logs, periodic log) upon operator's request,

g) Perform computational functions,

h) Perform data archiving functions,

i) Provide facilities for VSAT/Leased line communication with Corporate Office,

j) Provide facilities for training and simulation of the control system,

k) Automatic management of unit starting, stopping, running in different stable states and transitions,

l) Execute joint control for automatic operation of the plant,

m) Monitoring of reservoir level, gates and flow regulations and process hydraulic data calculations and also monitor for trash rack plugging conditions,

n) Provide an interface/module complete in every aspect for remote control of the entire plant from Load Despatch Centre. The system should comply with IEC protocol standards to communicate with remote despatch centre.

14.5.4.2 Large Screen LED Display

Large Screen LED wall Display of size 162" diagonal with display wall controller, 36 Tiled Bezel less .fine Pitch LED Video Wall.. The resolution shall be 1920x1080 / Quadrant (min) Overall wall resolution 3840X2160 (min) . It shall be supplied with Control PC with Software For Video Wall management and one dedicated Controller for video wall Contrast Ratio 5000:1 Brightness 600 nits, Aspect Ratio 16:9 Orientation Landscape with Mounting on base. Industrial Grade Video wall graphic controller, Video wall control PC With wall management Software, keyboard & Mouse shall be provided/

The industrial grade Video wall graphic controller shall be equipped with min 10 nos RJ 45. 4 nos HDMI, 1 USB port with touch screen display for

parameter configuration. The minimum configuration of Video Wall Control PC shall be : Processor Intel Core i7-13500 Processor. Ram Memory 16GB DDR5 RAM. Hard Drive HP 512GB SSD with 1no. SATA SSD, NO ODD. Graphic Interface Card HDMI Port Graphic Card. Optical Drive 1no. On-Board Giga NIC, USB Port 5 Nos. Power Supply ,100 to 240 VAC, 50 / 60 Hz, Operating System Microsoft Windows.

The display screen shall have a high viewing angle of at least 160° vertically and 140° horizontally and shall have adequate level of brightness for display in ambient light conditions of the control room. The system shall have automatic colour and brightness control feature. A digital clock with date and time indication shall be provided on top of the display.

14.5.4.3 Operator workstations

The Operation and monitoring of entire power plant process shall be done through PC based Operator workstations The operator consoles shall assist the operator for an easy operation and control of power station and shall allow to print out and to show on the displays, all relevant signals, events, alarms, status, status changes, abnormalities, history data and plant conditions on request or immediately in case of alarm and shall allow to take print out and to show on the displays..

The operator workstations shall ensure the function of the man-machine interface. In the control room two operator workstations with desks shall be provided. Each operator desk shall be equipped with two VDUs, standardized keyboard and pointing device such as mouse/trackball, integrated telephone set, microphone, writing pad and workplace integrated. Each of the two monitors, attached to the workstations, shall be interfaced to be capable of displaying any of the selected plant control mimic views.

All the Operator workstations shall be implemented in such a way so that each workstation shall be capable of individually controlling the entire control system even in the case of failure of all other workstations.

The configuration of each workstation shall be:

i) Two monitors each of at least 26" LED backlit flat screen and flicker-free,

ii) At least Octa core Processor CPU with 3.2 GHz processor and Mother Board Front Side Bus speeds available at the time of supply,

iii) Minimum of 16 GB DDR3 or Higher RAM,

iv) Two (2) or more – Hard Disk Drives with latest technology each of at least 2 TB capacity,

v) DVD writer,

vi) Latest USB (3.0 or higher, if available at the time of procurement) hub and ports,

vii) Key board of standardized type suitable for Hydro power plant environmental conditions

viii) Pointing device such as mouse.

The workstations shall be high performance systems with latest configuration available at the time of supply. They shall be loaded with latest 'Professional version' of Microsoft Office Suite. The operator desks, to be supplied by the Contractor, shall be provided with all accessories, telephone desk-type, power socket outlets, provision for public address system installation etc.

14.5.4.4 Mobile Operator Station

One number of Mobile Operator Station with attached portable laser printer shall be provided with all the databases and software, all necessary interfaces and connectors so that they can be connected to any of the Local Control Boards directly, to control the board as and when necessary in cases of failure of Plant Control Network. In addition to the above software shall be loaded with latest 'Professional version' of Microsoft Office Suite. The Mobile Operator Station shall be used for complete control of the specific connected Local Control Board or Unit Control Board and all the associated auxiliary equipment. They shall also have event log functions. These workstations shall have Wi-Fi wireless LAN connectivity and should be designed to withstand high humid conditions and machine hall environment. The printer shall be used to take report, event, hard copy or alarm printouts as and when desired by the operator. The operator station shall be having the following, but not limited to features apart from others mentioned above:

i) At least Quad core 3.0 GHz processor

ii) At least 2 TB Hard disk with latest technology

iii) At least 16 GB DDR3 or higher RAM

iv) DVD writer

v) Two 10/100/1000 Ethernet ports

vi) Other standard ports (USB/HDMI/DVI/Bluetooth adaptors etc.) including ports to be used for connectivity with UCBs/LCBs/relays/governor/DVR etc.

This station shall be installed on separate desk in the control room and connected to the control room network The desk shall have separate monitor, keyboard, mouse and other necessary accessories connected with APR interface.

14.5.4.5 Engineering stations (fixed)

One Engineering Workstation with separate desks shall be provided. The Engineering Station shall be equipped with single 26", full HD resolution, flicker free LED backlit flat screen monitor and other hardware configuration same as that of Operator Workstations mentioned above. These stations shall have the following features including software for:

i) Reprogramming,

ii) Process simulation,

iii) Engineering calculation,

iv) Database management

v) Program testing,

vi) Documentation,

vii) Down loading and uploading of programs

viii) Low level expert system tester,

ix) Changing parameters in mimics/logics or in setting of parameters.

x) Training functions.

xi) Mimics development

Software and programming tools provided shall be responsible for the definition and creation of all mimic views to be displayed. From this desk, it shall be possible to follow the control and operation and to execute trouble shooting, reprogramming, parameter and set point changes and all necessary work to support and maintain the system. Each Engineering station shall be provided with latest 'Developer version' of Microsoft Office Suite. The engineering station shall be having the following (but not limited to) features apart from others mentioned above:

a) At least Octacore 3.2 GHz processor

b) At least 2 TB Hard disk with latest technology

c) At least 16 GB DDR3 or higher RAM

d) DVD writer

e) Two 10/100/1000 Ethernet ports

f) Other standard ports (USB/HDMI/DVI/Bluetooth adaptors etc.)

14.5.4.6 Portable engineering station (movable)

One portable engineering workstation with all features and accessories to maintain, reprogram, check the status and test the LCB programmable controllers, loaded with all software & system configuration settings similar to fixed engineering station necessary for the purpose, shall be included in the scope of the supply. In addition to this, this station will be equipped with necessary software & ports to programme test, data downloading & analysis for Protection relays, Governor and Digital voltage regulator described in other chapters of this document. Portable engineering station shall be a Laptop loaded with all software & settings similar to fixed engineering station necessary for the purpose. The portable engineering station shall be having the following, but not limited to features apart from others mentioned above:

a) At least Quadcore 3.0 GHz processor

b) At least 2 TB Hard disk with latest technology

c) At least 16 GB DDR3 or higher RAM

d) DVD writer

e) Two 10/100/1000 Ethernet ports

f) Other standard ports (USB/HDMI/DVI/Bluetooth adaptors etc.) including ports to be used for connectivity with UCBs/LCBs/relays/governor/DVR etc.

14.5.4.7 Simulator and training

One separate simulator station with all accessories for operational staff shall be integrated into the system and included in the scope of supply. The software shall consist of standard and easy to use simulation of the hydro power plant and complete on line documentation to allow the operator to train himself at using the control system. Adequate training of the operator personnel for acquaintance of the system is included in the contract.

14.5.5 Unit Control Boards (UCB)

Dedicated Unit Control Boards with HMI shall be installed for each turbine-generator unit. The governor, excitation system and protection panels shall be integrated with Unit Control Board. These boards shall communicate with the central control system through the Plant Control Network. The main and redundant unit controllers shall be mounted on Unit Control Boards together with all the electrical and mechanical protections of the generating unit, its auxiliaries, generator step- up transformers and measurement of all parameters of the unit. All facilities, equipment and interfaces shall be provided for complete local control of the unit from Unit control board in "Local Manual mode".

Each Unit Control Board shall comprise of the all the required control and monitoring devices and components required for operation of the unit including:

1) Redundant controllers with redundant power supply distribution,
2) Necessary I/O module racks,
3) Redundant bus and sub-local network as per requirement
4) All necessary I/O interfacing,
5) One colour Human-machine interface terminal to perform local supervision and control of the unit and its auxiliaries,
6) Control and monitoring of generator fire fighting system,
7) All condition monitoring of Unit such as Vibration, bearing temperatures, stator and rotor temperatures, transformer monitoring etc,
8) Necessary energy meters for metering ,
9) Automatic and manual synchronizing devices and one synchroscope,
10) Brake dust collection system,
11) Cooling water system,
12) High pressure automatic lubrication system,
13) Governor oil pressure unit,
14) All analog indications/ meters including MVAR and Power factor.
15) Stator heating system,

16) Main inlet valve,

17) Integration with unit protection devices and their monitoring as described in "Section 15 – Protection System",

18) Covered push button and necessary controller for unit emergency shutdown, Emergency shutdown shall be implemented with hardwired logic using Safety Relays (SIL-3, IEC61508), in addition to the emergency shutdown controller for redundancy,

19) Other systems not mentioned but are essential for working of the unit.

Each Unit Control Board shall perform at least the following functions:

i) Monitoring of draft tube gate indications,

ii) Control and monitoring of inlet valve,

iii) Local acquisition of the logic and analog information from generator, excitation, turbine, governor, unit auxiliaries, unit protection and generator transformer, sensors and actuators,

iv) Local dating of events through the programmable controllers with high resolutions of 1milli second,

v) Management of unit starting, stopping, running in different stable states and transitions,

vi) Management of emergency shutdown of the unit,

vii) Control of the process actuators with necessary interlocking and protections,

viii) Alarm supervision,

ix) Monitoring of protection system,

x) Automatic and manual synchronization control,

xi) Management of the local operator terminal (HMI),

xii) Communication with measuring devices,

xiii) Communication with all condition monitoring systems of the unit such as temperature-monitoring device, vibration sensors, etc,

xiv) Communication with the other controllers and Local Control Boards and computer system through the Plant Control Network.

In manual mode, the operator shall be responsible for the good progress of the operating sequence from the Unit Control Board and Local Control Cubicles. Only basic interlocking shall be provided in order to prevent damages to the unit. Orders are initiated through Local Control Cubicles. Otherwise, when the "Local Automatic" mode is selected, all the control and monitoring is made through the HMI of the Unit Control Board. Control from the Local Control Boards shall be possible even when upper levels are out of order.

Sequence controllers shall be provided with all indications on the Central Processor Unit that are required for trouble shooting in case of failures such as:

a) Missing start conditions,

b) Missing conditions for the next control step in case of sequence fault,

c) Actual step and sequence.

All status information from the logic controllers shall be also transmitted to the Central Control Room (CCR).

All necessary controls and devices shall be provided to allow manual control and synchronization of the generators from their UCBs while the basic safety interlocking and the protection remain operative.

14.5.5.1 Modes of operation

The following operating modes shall be selected via a key or code operated selector switch installed in the UCB:

i)	OFF	No operation possible
ii)	MANUAL	Manual control from UCB
iii)	AUTO	Automatic control from UCB
iv)	CR	Automatic control from Central Control room
v)	TEST	Self testing diagnostics

14.5.5.2 Sequential control

The automatic starting and stopping of the unit shall be initiated by covered start and stop push buttons. All the component elements of the hydraulic system shall be operated according to a logic and sequential manner, which shall bring the unit to the synchronized condition and automatically synchronized or stop it completely when the stop push-button is pressed.

Video mimics on VDUs of the Central Control Room shall indicate all step indications. All indication signals shall be disabled/switched-off, when status "stand still" or "general overhaul" is achieved.

The controllers used for sequential control shall be provided for the following operating modes:

i) Automatic control.

ii) Step by step control.

iii) Test simulation of the input signals by setting, while input cards shall be blocked

iv) Complete program tests, while output cards shall be blocked

14.5.5.3 Manual control of unit

Unit Control Boards shall be provided with all features, accessories, wiring, indications, and meters that are necessary for manual control of the unit locally through the unit programmable controllers. It shall be possible to operate generator circuit breaker from UCB even when upper control levels are out of order.

14.5.5.4 Alarms

Each Unit Control Board shall be provided with an Alarm and Annunciation System with all equipment to achieve the required functions, such as alarm units, Annunciation panels, horns, transmission facilities.

14.5.5.5 Temperature measurement

All RTDs for measuring and monitoring temperature of Stator core, teeth, winding, bearing (Pad & Oil), CW, Hot air etc and for other systems . shall be integrated with SCADA. The controller shall acquire these signals through RTD cards of the I/O rack and shall be suitably depicted in mimic. Alarm/trip settings for high temperature shall be adjustable over the entire range. Temperature measurements shall also be available on the HMI of the UCB and shall be printed out in the control room on demand.

14.5.5.6 Generator Step-up Transformers

All Generator step-up transformers shall be monitored, controlled and supervised with the electrical system delivered with "Generator Transformers" for temperature, cooling water system and fire fighting system.

14.5.5.7 Synchronizing equipment

Synchronizing facilities shall be provided from control room to allow automatic synchronizing of the units. Local Control Boards shall have the features to synchronize units both manually and automatically whereas GIS and outdoor Switchyard LCB shall have the feature to synchronize the transmission line and bus coupler manually.

The fully automatic synchronizing devices shall be of the electronic type, comprising of auto-synchroniser, rotary switches, synchronising relays, DFM, DVM, synchroscope etc. complete with all auxiliaries for automatic connection of the generators to the grid.

The circuit-breaker closing time, maximum admissible frequency & voltage difference as well as the control time shall be adjustable.

Selector switches off / test / manual / automatic and all necessary instruments for manual synchronizing shall be provided at the Unit Control Boards.

The automatic synchronizing shall also be possible when the generating units are controlled locally from their respective Unit Control Boards and plant control network is non-functional.

14.5.6 Local control Boards (LCB)

14.5.6.1 LCB for Electrical Power Supply Service

One LCB shall cater to the electrical power supply needs of all the power house equipment and auxiliaries. The board shall perform control, metering and monitoring of the following general functions:

i) Electrical power supply distribution including DG sets, Unit Tap-off Transformers, Station Service Transformer,all 0.415 kV

boards including UABs/SSBs, all 11kV switchgears and feeders .

ii) 220 V DC supply,

iii) Protection interfaces for all the above systems.

All MV and LV switchgear including DG sets and spare panels, if any, shall be remotely controllable. All start-up sequences, interlocking in addition to hardwired safety interlock provided in respective panels and switching operations of MV and LV switchgear shall be controlled from this LCB.

14.5.6.2 LCB for Common & Station Services ~~& Dam control~~

The LCB shall cater to the common services of the power station and shall perform control and monitoring of the following general functions:

i) Low pressure compressed air system for brake and service air etc.

ii) Cooling water system,

iii) Drainage and dewatering system.

iv) Ventilation and air conditioning system,

v) Fire fighting system,

vi) Tail water level monitoring

vii) Downstream discharge monitoring

viii) Any other station services,

ix) Dam Monitoring

14.5.6.3 LCB for GIS control

One (1) number of LCB shall be provided for control and monitoring of 400 kV GIS & pothead yard, and Bus reactor. It shall perform the following general functions:

i) Control and monitoring and protection interface of complete 400kV GIS and Pot yard system and Bus reactor

400 kV GIS & Pothead yard shall be supervised, interlocked and controlled from this Local Control Boards. Necessary control and alarm functions along with data acquisition of parameters shall be provided. The protection cubicles described in Protection Package shall be integrated into the respective LCB as a protection panel. All the bays shall be controlled and operated safely, reliably and efficiently in all modes of control i.e., remote, local and manual. The Control Boards shall cover the following:

a) Complete protection and monitoring equipment of the GIS, Bus reactor and Pothead yard

b) Operation of Breakers with various interlocks,

c) Operation of Isolators, earth switches, etc. with various interlocks,

d) Interfacing of various protections of lines / feeders and Bus Coupler as applicable,

e) Interfacing of gas monitoring equipment both hardwired and software.

f) Metering of all lines / feeders as applicable.

14.5.7 Router/Gateway for Remote Monitoring and Operation

A gateway shall be provided for remote monitoring, control and operation of entire power plant from a Remote Control centre (RCC). It shall be the responsibility of the contractor to provide and install necessary routers/gateways, interfacing and other accessories for remote operation, control and monitoring. The communication protocol shall be based on IEC 60870-6 series TASE.2 (ICCP) standards. The gateway should accept the binary command and analog set points from RCC for operation and control of entire power plant. However, the final selection of protocol shall be made at the time of detail engineering.

The overall control shall be affected from the Central Control Room (CCR). Provision shall be made to adopt the control system for remote monitoring, control and operation from RCC. The highest control level shall be with Operator workstation in Central Control Room (CCR) at powerhouse only. From the operator workstation of power plant at CCR, the operator shall be able to perform real time control and adjustments for all the equipment of power plant.

As a standard implementation, the power plant local control room (CCR) should always be the Master with RCC being in monitoring mode. When CCR allows remote operation from RCC, the mode should be change from monitoring to operation and control at RCC. When RCC is in operation and control mode, this shall be display in the mimics in the control room (CCR).

Provision shall also include a workstation to be commissioned with, necessary routers/gateways, interfacing and other accessories at Uri I Stage I Power House for Supervisory control of the entire power plant from Uri I Stage I HEP,

Necessary OFC, Terminal Equipment along with other accessories shall be provided, erected and commissioned in all respect by the contractor at both ends.

14.5.8 Provision for remote data transmission to Corporate Monitoring Centre and Load Despatch Centre

Router / gateway with necessary firewall functionality, interfaces (including modems for PLCC linkages like NSK5 or better), terminal units and accessories shall be provided suitable for following communication/data transfer modes:

i) Power house to Corporate Monitoring Centre through NHPC's CUG SCPC PAMA VSAT network / MPLS based Leased line.

ii) Power house to Regional Load Despatch Centre through PLCC/OPGW.

iii) It will be the responsibility of contractor to provide implementation profile during detailed engineering for examining the interfacing with RLDC and Corporate Monitoring system profiles for compatibility of data transmission and final integration of specified plant data. The communication protocol for gateway to RLDC shall support IEC 60870-5-104 for all levels. Protocol gateway specifications shall be decided during detailed engineering.

14.5.9 DELETED

14.5.10 Local control cubicles

Separate Local Control Cubicles (LCC) provided for unit auxiliaries, Station services and Common services shall be controlled along with complete sequence interlocks from the LCC itself, corresponding Local Control Board and also from the Central Control Room.

All logics with I/O connections for manual as well as auto operation of the auxiliary shall be built into Local Control Cubicles. Each Local control Cubicle shall be able to perform all its functions in auto and manual modes even when corresponding Local Control Board is not functional or even when communication between LCB and LCC is not established. Each Local Control Cubicle shall be supplied with two selector switches; one switch for selecting between remote operation and local operation and another switch for selecting "Local Auto" mode and "Local Manual" mode. The local control systems shall be controlled locally, from their respective Local Control Cubicles when selector switches are used for "Local Manual" mode.

Required signals and information shall be transmitted between cubicles, local control board and central control room through redundant optical fibre field bus connections. Suitable numbers of I/O switches at respective floors shall be provided from where signal/ data is transferred to LCB/ CCR though optical fibre.

14.5.11 Software

All software along with necessary licenses, required for performing intended duties in an efficient manner, shall be provided in addition to the software explicitly specified for individual equipment. The source codes of project specific application software shall be the property of the Employer. The software shall be modular in structure, facilitating changes and extensions of the system. Complete literature including program listings in source language for application and customized application software shall be provided. All documentation and computer print-outs shall be in English only. All software shall comply with open system standards, shall make optimal use of CPU, main memory, and disk space, and shall not cause any problem for the operating systems.

14.5.11.1 Operating system

The operating system shall be latest Windows based network operating system available at the time of supply with a standardized, user friendly look and feel. All Servers shall be based on latest Enterprise edition of windows based Server operating system available at the time of supply.

14.5.11.2 Application software

The purpose of the Application Software is to allow a complete control and monitoring of the plant. The Application Software shall be structured in various levels. The lowest level shall assure system performance and contain basic functions / Application programming interfaces (API), which shall not be accessible by the application and maintenance Engineer for modifications. In order to ensure robust quality and reliable software functions, the main part of the application software shall consist of standard modules built as functional block elements based on Object Oriented Programming in Standard programming language. The functional blocks shall be documented, thoroughly tested and formed into a library. The software shall be implemented in the computer systems of the control room. All operating parameters shall be modifiable by the operator and necessary interfaces /mimic views/ forms shall be provided for assigning set points with respect to voltage, load settings etc, assigning unit priorities, and giving direct orders/commands to the system.

All necessary provisions such as firewalls and other security measures shall be strictly implemented so as to insulate the Control system, networks, plant data bases etc. from unwanted intrusions.

Security mechanism of control system shall include the provisions so that no unauthorized person can fiddle with pre-set program/ software of control system of the machine. Security measures like providing hardwired key or USB drive soon after loading of program/software or any other arrangement shall be included so that no secondary device can be played without real key/set of keys.

14.5.11.3 Power house intranet

The software supplied by the Contractor shall also include a Power House Intranet Site containing complete information in web pages regarding the working of the power plant with all status reports and information, Maintenance procedures, drawings and detailed documentation of all the equipment of the powerhouse.

The Intranet and its web pages shall be designed to provide access to information of the powerhouse and other details from any computer connected to the Central Control Room Network with appropriate passwords and Access Restrictions at different levels. The Intranet site shall be complete in every aspect with necessary web server and other peripherals, containing full details of all powerhouse equipment, their maintenance procedures, drawings etc. The Contractor shall supply any other software necessary to run, maintain, update and modify the Intranet. The Intranet and its web pages shall be so implemented as to present information in a well-organized and easily understandable manner for use by persons without any technical background.

14.5.11.4 On-line help and diagnostic system

Apart from the printed documentation manuals, the Contractor shall also provide all of his documentation online including equipment drawings and other details. The basic features of online help shall include but not restricted to the following:

i) Operator Manual detailing all aspects of the Control system.

ii) Engineering drawings of equipment.

iii) Maintenance Manual describing any maintenance duties which need to be carried out on the Control system.

iv) Troubleshooting Guide out-lining how to resolve numerous difficulties and problems, which operators may encounter with either the control system or the equipment being monitored by the Control system.

This documentation shall provide extensive cross-references and search facilities to aid during training and familiarization period and to increase efficiency afterwards.

A comprehensive diagnostic system shall be provided to assist the operator in minimizing the downtime. The system shall guide the operator:

a) To analyse all available information,

b) Diagnose the problem,

c) Resolve the problem.

Any information that is available to the control system shall be presented to the operator in a clear and consistent manner. Necessary diagnostic screens containing status information shall be provided.

14.5.12 Process Control Networks

14.5.12.1 Central control room network

A separate control room network shall be used in the control room to link the Operator's Workstations, Engineering Stations, Training Simulator, and other peripherals. Central control Room network shall be redundant twisted pair Cat 5 cables, based on the TCP/ IP Ethernet Standards at 1GBPS data transfer rate. The separate Control Room Network shall ensure to relieve the Plant Control Network from print jobs and dedicate the later only for transferring process data.

The Control Room Network shall be extendable to connect Power House LAN installed in the power plant. The plant computers and servers shall be connected to this network, through routers and firewalls which shall be provided with the Central Control Room Network to restrict unauthorized access to the control room network and other process networks.

The network shall have redundant PC based Data Storage Systems necessary for automatic backup of online process data. The fiber terminations in the control room Network (LAN) shall be housed together in a closed unit along with the necessary switches. The routers, serial and digital interfaces of communication network, Ethernet switches etc should be provided with surge protection devices of suitable rating.

Two servers shall be used. Latest windows based operating system shall be pre-loaded on these servers. The two servers are pre loaded with latest version of Microsoft office suite along with any other software required for performing their intended functions.

14.5.12.2 Plant Control Network

The data transmission between the Local Control Boards and the workstations shall be implemented through a redundant fiber optic Plant Control Network. The network shall be based on ETHERNET standard and use of TCP/IP protocol. 1GBPS data transfer rate shall be used to guarantee fast and reliable data transmission. The two redundant optical fiber buses shall be routed through physically different paths.

14.5.12.3 Power House LAN

Redundant Power House LAN of 1 GBPS transfer rate complete with Gigabit Ethernet LAN switches for at least 24 connections spread across the powerhouse area, all necessary interfaces, routers for LAN/WAN connectivity, connectors, Power Supply, UPS and other accessories shall be provided. Suitable number of Wireless LAN hot spots with all necessary accessories including 24-port wireless switches, access ports etc, shall also be provided for coverage in Training hall, Conference Room and Machine Hall Floor.

The Plant Computers / Servers / Printers shall be of latest technology and hardware, available at the time of supply and shall serve the supervisory and maintenance functions by various departments, laboratories and workshops in the powerhouse. The configuration of these computers shall be subject to the approval of the Employer. The two Servers shall be used for Administration Control of the Power house LAN, Management of Inventory and Web Server for the Intranet site. Latest Windows based Network Operating System shall be pre-loaded on these servers. All Plant Computers shall be preloaded with latest professional version of Microsoft Office suite along with any other application software required for performing their intended functions. All the two servers in Power house LAN shall be preloaded with latest Developer version of Microsoft Office suite along with any other application software required for performing their intended functions.

Each of these computers shall have a full HD resolution flicker-free LED backlit flat screen colour monitor of 26". These computers shall be furnished with all connectors, I/O cards, interfaces, UPS, software etc that are necessary to connect them to the Power house LAN. These computers shall be pre-loaded with all software necessary to access and process information of the power plant. Appropriate passwords and access rights shall allow the users of these computers to access relevant data of the power plant such as trends, reports, alarms etc.

14.5.12.4 Bus system

The data transmission shall be through redundant optical fiber cables.

The bus systems shall be self-monitoring type. The main characteristics of the bus system shall be as follows:

i) High reliability of communication realized by double bus (redundant) system. The two systems shall continuously operate separately only in case of traffic interruption on one bus, the other shall take over the traffic. By this principle all bus couplers, bus

interfaces etc. shall be coupled with one active and one stand-by device forming a complete system,

ii) The bus-systems shall be physically redundant installed on different routes,

iii) Real time, full duplex data transmission rate, of at least 1Giga Bytes per second shall be provided,

iv) Interfaces shall be according to relevant IEC standards

14.5.12.5 Optical fibre

Design of optical fibres shall be in accordance with recommendations and practices of relevant IEC standards and ITU-T series standards.

Optical source safety shut off shall be provided to prevent exposure to laser light during maintenance. Equipment shall have sufficient test points to facilitate complete monitoring of the equipment performance without service interruption. Fibres shall be designed to limit degradation after thirty years of intermittent exposure to stagnant water, ambient temperature and 100% relative humidity conditions.

The availability of 1 Gbps data channel between two remote stations shall be greater than 99.99% and this availability shall consider a maximum mean-time-to-repair (MTTR) of 2 hours.

The Administrative building at colony and power house of Uri I Stage I shall be linked through ADSS optical fiber cable. The link shall provide facilities for voice and data channels required for monitoring. The optical fiber shall consist of at least 12 cores and shall be of single mode type.

14.5.12.6 Communication interfacing

Dedicated bandwidth VSAT/Leased line communication forming part of Employer's CUG (Closed User Group) network shall be provided by the Employer for data transmission and communication between power house control room and corporate office control room. The VSAT link shall be a SCPC PAMA link/ KU band based Leased line shall be MPLS based network.

The Contractor shall provide router/ gateway with necessary firewall functionality, interfaces and accessories suitable for communication between power house control room and corporate office control room & power house control room and Uri I Stage I sControl room through Employer's CUG (Closed User Group) network. The interfaces on the router to which VSAT/Leased line IDU shall be connected should be serial WAN interface catering to speed of at least 2 MBPS or higher for which technology is commercially available at the time of supply.

Voice & data transfer to Uri I Stage Iss along the OPGW link and to RLDC along PLCC shall also be established with necessary security Features.

The Contractor shall perform network testing in order to demonstrate all the network features desired.

14.5.13 Audio visual alarm system

Each Local Control Board shall have its independent facilities for Alarm and Annunciation. The system shall be complete with Horns, alarm network/cabling etc. In addition to the above, all alarms shall be presented to the operators in the central control room through audio visual indications. Suitable provisions shall be provided at all Local Control Boards including Unit Control Boards such that the audible alarms shall be activated or deactivated and option shall be available for freely selecting the location for annunciation of audio alarms - either at operator workstations of Control Room or at respective Local Control Boards. Alarms may be acknowledged from only one operator station at a time.

i) There shall be an alarm manager function catering to all the alarm services in the Central Control Room.

ii) Proper mechanism for sorting and filtering of alarms shall be provided.

iii) Each alarm shall be time tagged.

iv) There shall be classification of alarms at least for four levels of priority each priority being associated with a distinguished colour code.

v) Each raised alarm shall be provided with a suggestive course of action associated with its alarm display window to aid the operator in quick assessment of the fault.

vi) There shall be proper filtering of the alarms thus eliminating non-significant alarms in a systematic manner.

vii) Alarms are to be classified at least by the following views:

- Alarms by degree of priority,
- Alarms by mimic view,
- Alarms by functional subset.

viii) During remote operation from the Central Control Room, the audible sound shall be silenced by automatic acknowledgement after 1 min.

14.5.14 Data logger and Data Storage System

An on-line Data Storage and Retrieval System shall be provided for the power plant. It shall be located in the Central Control Room area and shall be equipped with storage media for real time data storage and for archival purposes. The data logger of the system shall receive, update, print out and show on the VDU's all signals, events, alarms, status, status change, abnormalities and history data of plant and ambient conditions either periodically, on request or immediately in case of alarm.

All real time plant data shall be stored on high performance, high capacity and redundant PC based Storage systems of minimum 1 TB capacity or maximum available HDD capacity at the time of supply to store the plant history data The information stored by these storage appliances shall be available on-line with automatic "hot" backup of on-line data and ready to

be shared by clients and servers on the Central Control Room Network and Power house LAN.

In addition to above redundant NAS devices on open system architecture to connect them to other vendors' equipment shall be used for archival and retrieval purpose. Each Network Attached System (NAS) shall be of minimum 8TB or higher capacity.

One dedicated Relational Database Management System based on latest available version of RDBMS database software, with necessary network user licenses covering all the workstations and computers shall be provided.

The Data Storage system shall be a 24 x 7 x 365 type storage database consisting of time tagged event logs with versatile data retrieval tools in the form of curves and in the form of chronological lists of tagged events. The Data Loggers and Retrieval System should be protected from both side i.e from power input side and from communication input side with surge protection device/better of suitable rating .These should be pluggable device and should have indication facility.

14.5.14.1 Trending and Charting

The system shall provide detailed variable monitoring functions for trending and charting. Detailed list of features and functions shall be approved by the Employer during detailed engineering. The trend curves of variables should have selectable sampling ranges. Both time and value scales shall be modifiable by the operator.

14.5.15 Video Display Units (VDU) and key boards

All monitors/Video display units (VDU) supplied shall be flicker free, full HD resolution, flat screen LED backlit colour monitors of 26" or above diagonal screen size. The pertaining software shall be included in the scope of supply.

The desk shall be equipped with keyboards, assisting the operator in easy operation of the power plant. Special care shall be taken in designing the keyboards taking ergonomics into consideration. The keyboards and keypads shall be of standardized type suitable to withstand high humidity environments.

14.5.16 Printers

The selection of peripherals shall take into consideration aesthetics with noise level not to exceed than 60 dB. All the printers shall be of heavy-duty, high speed laser type. The printer shall have minimum 1 GHz processor, 2 GB RAM, USB port, 10/100/1000 Mbps Ethernet ports, touch screen (LCD) display, standard paper handling trays for A3/A4 size paper, print speed o at least 40 pages per minute with quality of 1200 X 1200 dpi and shall be compatible with window operating software. Colour printer shall have additional provision for scan and copy.. All peripherals shall be provided with necessary desks, paper baskets and noise absorption.

14.5.17 Control room furniture

14.5.17.1 General

The control room layout of furniture shall be state of the art and aesthetically designed in synchronization and resemblance to the control room equipments by specialized architectural vendors having proven track record in this field. Control Room Layout of furniture shall include, but not limited to the following:

i) One (1) set of Modular control desks for Operators Stations

ii) One (1) NO. Modular printer tables for each printers

iii) One (1) no. modular computer tables for each of the following:-

a) Engineering stations

b) Historian stations

c) NAS

d) Plant computers

e) Plant servers etc.

iv) Control room chairs

All the furniture should look of same family for better aesthetics, ergonomics, comfort etc. Various aspects should be considered and extreme care shall be taken while designing control room layout so as to create ideal work place. Physiological aspects such as line of sight & field of vision and cognitive factors such as concentration & perceptivity etc. shall be considered with special care.

All the control desk, computer tables, printer tables shall have receptacles for receiving incoming power supply & outgoing feeders with proper mounting of MCBs, spike arresters etc. and necessary jacks for telephone & power house LAN. All the cable trays shall run internally. The system should provide a good cable routing system with concealed cabling for power & instrumentation cables, telephone cables and networking cables. The cable entry to the console shall be from the bottom. The separation necessary between network and power cabling shall be taken care of. All trays should be easily accessible during installation and maintenance. The horizontal cable tray shall have arrangement to accommodate plug connectors and sockets of varying sizes.

The colour of the board in desk surface, shutters, other furniture and architectural design on acrylic solid surface shall be decided during detailed engineering.

All equipments, accessories and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC.

Various aspects should be considered and extreme care shall be taken while designing control room layout so as to create ideal work place. Physiological aspects such as line of sight & field of vision and cognitive

factors such as concentration & perceptivity etc. shall be considered with special care.

14.5.17.2 Furniture

The contractor shall provide a set of ergonomically designed furniture from a reputed manufacturer especially designed for computer peripherals. The set of furniture shall include the following:

A) Control Desk:

The Modular open workspace console system to be installed shall provide conveniently organized work surfaces to install the control room equipment and also to provide work surfaces for the operating personnel to carry out the operations. The control desk shall accommodate operator stations, hidden keyboard and mouse, integrated telephone set, microphone, writing pad, emergency push buttons etc., and shall have adequate working space. Arrangement with arm extension and tilting facility shall be provided for the telephone sets.

The facility is intended to be a state of the art facility for control operations. Aesthetics, convenient organization, flexibility, finish, durability are very important attributes of the console system. All materials and accessories used in the construction of console system should be of high quality and finish should be of international standards for control centres.

The System should be non-welded modular construction system with provision for extension and expansion. The modular construction shall allow adding and relocating the modules to meet the future requirements. Material of construction shall be in extruded aluminium with powder coating in approved colour.

Control desk surface shall be made of high quality 12 mm Acrylic Solid Surface on 25 mm thick MDF and shall be powder coated aluminium sturdy structure. The top layer of the surface shall be capable of withstanding day to day usage of the work surface (Free usage) without losing the high quality finish. The surface should have following features.

i) Non-porous (does not hold dust).

ii) Seamlessly joined (no joints will be visible throughout the desk)

iii) High scratch resistant

iv) Repairable (in case of any scratches / requiring just normal buffing to regain its normal form)

v) Homogenous (Textures visible on top surface are present throughout the depth)

vi) Boiling water resistant

vii) Bacteria, Fungi and Termite proof

viii) High temperature resistant (180 degrees no change)

ix) Flammability (Class 1/Class A as per ISO)

x) High Impact resistant etc,

Shutters made of high grade MDF board of 18 mm thickness with auto closing hinges shall be provided.. The support legs for the vertical support

system should be provided with levelling mechanism for compensating minor flooring variations.

The CPU cabinet with rotatable trolley/sliding tray should be integral part of each module. Proper cooling arrangement shall be considered while designing console.

Vertical Support should have adequate height & base depth and minimum 2.5 mm thick suitable extruded aluminium beam to hold Mounting base, Tabletop surface and LED monitors, Tilting tray, Side & top aluminium profiles for stiffening and providing strength and wire-way. Suitable flexible arms moveable in all directions shall be provided for LED monitors. Foot extension in Cast aluminium, powder coated in approved colour/shade.

The structure frame shall consist of extruded aluminium top and bottom horizontal beams and vertical support tensioned together to form an integrated, finished, robust frame. All frame assemblies and equipment support are built-off the structural frame. Structure shall be powder coated (the colour code shall be approved during detailed engineering).

A Valence of extruded aluminium should run throughout the length of console providing light on work surface top to maintain the appropriate lux level on table top. Also it shall be possible to mechanically dim the light on work surface.

The Edges of the tabletop shall be cut at an angle to give impressive look.

The system shall have receptacles for receiving incoming UPS power supply and outgoing feeders with proper mounting of MCBs, spike arresters etc., and necessary jacks for telephone & powerhouse LAN. The control desk shall accommodate operator stations each equipped with two VDUs, hidden keyboard and mouse, integrated telephone set, microphone, writing pad, emergency push buttons etc., and shall also have adequate working space. Arrangement with arm extension and tilting facility shall be provided for the telephone sets.

B) Computer Tables

The tables shall be of modular construction and have MDF board of approved colour with matching colour steel work. Suitable arrangement for placing the CPU below the top of the table using CPU trolley or any other means may be provided. Retractable keyboard holder using MDF board may also be provided. Arrangement for providing concealed wiring along with necessary jacks for telephone and powerhouse LAN shall be provided in an aesthetic manner. Power and LAN cable entry to the console shall be from the bottom and shall be unobtrusive.

C) Printer Tables

Printer table shall be of modular type. Desktop shall be made of 25 mm thick MDF and shall be powder coated aluminium sturdy structure.

All tables shall have receptacles for receiving incoming UPS power supply and outgoing feeders with proper mounting of MCBs, spike arresters etc. Boxes having provision for network and telephone connection shall be provided on table with each printer. Arrangement for providing concealed wiring along with necessary jacks for powerhouse LAN shall be provided in an aesthetic manner. Power and LAN cable entry to the console shall be from the bottom and shall be unobtrusive.

D) Chairs

It shall be Industrial grade with Aluminium extrusion at back and armrest. Chairs and control desk should look of same family for better aesthetics, ergonomics, comfort etc., Chairs shall have synchronized tilting mechanism Multiple locking systems, ABS for seat, Mesh back with extra lumber with fine tuning Knob for depth adjustment and height adjustable back, with swivel & depth & Height multi-dimensional adjustable arm pad & option of PVC padding, gas lift for height adjustment and Nylon base with castors.

14.6 Drawings, Documents and Design Calculations

14.6.1 Design memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 "Record and Documentation" of "Section 1- General Technical Requirements."

14.6.2 Drawings and documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in "Section 2 – Technical Documents" of "General Technical Specification (GTS)".

14.6.3 Design calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance.

i) Calculations to prove the overall availability of the system in accordance with "performance criteria and guarantee" for top order event as specified.

ii) Mimic views of SCADA system for customization as per employer requirement as per Annexure-I (enclosed).

iii) Details of Cyber Assets which uses a routable protocol to communicate outside the Electronic Security Perimeter or a routable protocol within a control centre and dial-up accessible Cyber Assets.

iv) List of communicable equipment/systems with life span / shelf life / time period for support from OEM.

v) Detailed procedure & flow chart for retrieving archival data (NAS) from operating workstation and from plant computers.

14.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 – General Technical Requirements

14.8 Spare Parts

Specified/mandatory spare parts shall be supplied in accordance to clause 1.8 "Spare Parts" of "Section 1 – General Technical Requirements". Specified spare parts to be supplied under this section are as follows:

S.No.	Description	Quantity
1.	Time Synchronizing network cables with connectors	1 nos.
2.	Power supply modules/unit	2 nos. of each type used.
3.	Electronics cards / Modules	4 nos. of each type used.
4.	Operator Workstation complete with monitor set, keyboard, mouse, etc	1 no.
5.	Data storage drives	1 no. of each type used
6.	Modem /repeater (if used) of each type	1 no.
7.	Optical fiber coupling unit	2 nos. of each type.
8.	Connectors, patch chords etc.	2 nos. of each type.
9.	Synchronizing device (comprising autosynchroniser, relays, rotary switches, synchronising relays)	1 no. of each used type
10.	HMI	2 nos. of each used type.
11.	Measuring transmitter	2 nos. of each used type.
12.	Sensors /transducers	2 nos. of each used type.
13.	Indicating & Measuring instruments	2 sets. of each used type.
14.	Relays	2 sets of each used type.
15.	Router/gateway with necessary firewall functionality	1 no. of each used type.
16.	Programmable controller	2 sets of each used type.
17.	Network switch	2 sets of each used type.

S.No.	Description	Quantity
18.	Meter reading instrument (MRI for SEM)	1 no.
19.	Energy meter and multifunctional meters	2 nos. of each type

One set is defined as total number required for one units.

14.9 Tools & Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 "Tools and Instruments" " of "Section 1 - General Technical Requirements".

14.9.1 Special tools

The Contractor shall list and supply all special tools. List of such tools including their make and detailed specification, shall be submitted for acceptance by the Employer.

The proposed list of special tools must include the following in addition to tools recommended by manufacturer(s):

i) Two (2) sets of crimping tools of each type used for installation of networks and cabling,

ii) One (1) set of optical time domain reflectometer,

iii) One (1) no. of fusion splicing equipment with accessories.

iv) One (1) optical power meter

14.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements specified separately in "Quality assurance and Testing Specifications (QTS)".

Annexure -1

Indicative List (but not limited to) of MIMICS for SCADA

Plant specific

1. Plant /Station Control Over View
2. Plant SLD EHV
3. GIS Protection overview
4. Plant SLD MV system
5. Plant SLD 415 V System
6. CW control overview
7. Station Aux Supply/DG supply Control
8. 220 V DC system overview
9. 48 V DC system overview
10. UPS/ Inverter system overview
11. Plant Drainage & Unit Dewatering system Overview
12. Shaft Seal cooling pump overview
13. HVAC cooling compressor pump overview
14. MAT / Transformer & other Drainage Pumps/Flood Pumps Overview
15. System configuration view 1
16. Communication Network Overview
17. HVAC scheme over view
18. Firefighting scheme Overview
19. LP/ HP Compressor overview
20. Gas/PD/Temp data of GIS/XLPE Cables as applicable.

Unit specific Views

1. Unit Start/Stop Sequence view
2. Unit Black start, quick stop, normal stop sequence, synchronous condenser overview
3. Generator overview
4. Turbine monitoring view
5. Unit GSU overview
6. Unit start up control view
7. Unit start-up check status over view
8. Temperature monitoring view
9. Vibration & Air gap monitoring
10. Auxiliaries control
11. Unit GOV OPU station control
12. Unit MIV OPU oil station control
13. Unit cooling water system
14. Unit Electrical trip conditions
15. Unit Mechanical trip conditions
16. Unit Governor trip conditions
17. Unit MIV trip conditions
18. Unit Turbine trip conditions
19. Unit Generator trip condition
20. Spare View for customization

Reports

1. Daily Generation schedule/ Actual Generation/ Aux consumption

2. Unit / Pumps running Hrs / Breaker Counters
3. Inflow report
4. Water level Report
5. Unit Start/Stop Sequence view
6. Unit Black start, quick stop, normal stop seq overview
7. Generator overview
8. Spare report for customization
9. Alarm & Events Reports
10. Blocked signal List
11. Bad tag /All tag list
12. DI/DO,AI/AO, temp list

Trends

1. All Station Parameters and Unit electrical & Mechanical parameters - voltage, current ,Frequency, speed, temperatures, vibrations, air gap, PD, tail race water level, intake/reservoir level etc.
2. Spare trends for customization

ATTACHMENT-5

A: LIST OF APPROVED SUBCONTRACTORS/VENDORS

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
1.0	**TURBINE AND ACCESSORIES**	
1.1	**Fabrication & Manufacturing of Major Parts of Turbine**	
1.1.1	SPIRAL CASING	GTV KCP TATA GROWTH SHOP DUNHILL PRODUCTS SUGO INDUSTRIES ISHAAN INDUSTIRAL CORPORATION GLOBAL HEAVY ENGG. INDUSTRIES MODERN ALLIED BHOPAL ENGINEERING SHIV ENGG.
1.1.2	STAY RING	
1.1.3	TOP COVER	
1.1.4	BOTTOM RING	
1.1.5	TURBINE SHAFT	BHARAT FORGE CO. LTD. CFFP, BHEL SUMITOMO CORPORATION, FOMAS, MORANDINI OFAR SPA, TRENTON WORKS, SCANA BJOR NEBORG AB, THYSEEN RHEINSTAHLTECKNIK GMBH, VOEST ALPINE, IMPSA ASIA SDN BHD, DOOSAN HEAVY INDUSTRIES, MILL-KVAERNER IMGB SA, ENERGOMASHSPETSCAL, NOVA FORGE CORPORATION, PILSEN STEEL, SAAR SCHMIEDE GMBH, NUOVA OFAR, SKODA KOVARNY(SKODA STEEL), PSN
1.1.6	GUIDE VANE CASTING	FOR CASTING: IMGB LITOSTROJ TAMARIS; FAP DOOSAN VOITH, ALTONA, MORENO ISGEC HEAVY ENGINEERING CFFP, BHEL CANADIAN STEEL FOUNDARIES Ltd. (CSF) STAR WIRE SAURABH METALS

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
1.1.7	DRAFT TUBE CONE	GTV KCP SIMPLEX MUKAND SANJAY FABRICATOR SEEMA ENTERPRISES TATA GROWTH SHOP DUNHILL PRODUCTS SUGO INDUSTRIES ISHAAN INDUSTIRAL CORPORATION GLOBAL HEAVY ENGG. INDUSTRIES MODERN ALLIED BHOPAL ENGINEERING SHIV ENGG.
1.1.8	RUNNER	FOR CASTING, BAND AND CROWN CANADIAN STEEL FOUNDRIES (CSF), TAMARIS INDUSTRIES; FAP, MANOIR INDUSTRIES, IMGB, LITOSTROJ, DOOSAN, VOITH ITONA MORENO, GRUPPO CIVIDALE LUCCHINI, MIL-SCHMIEDEWERKE GRODITZ GMBH, INDU STEEL (CREUSOT LOIRE), BHEL (CFFP) THE SARASWATI INDUSTRIAL SYNDICATE LTD, FERRISTOOL AG DELACHUAU SA, FRAVIT, ISGEC HEAVY ENGINEERING SAURABH METALS STAR WIRE FOR BLADE: SAME AS BAND AND CROWN MORENO, ISGEC HEAVY ENGINEERING
1.1.9	HYDRAULIC BOLT TENSONERS	ENERPAC HYDRATIGHT SPX POWER TEAM POWER MASTER, CYCLADES INDUSTRIES VIRGO ENGINEERS ADVANCE BOLTING SOLUTIONS TRITORC EQUIPMENTS PVT LTD NORDLOCK PILGRIM INTEGRA POWER TEAM
1.1.10	STEEL PLATES	DILLING- GTS- VENTES MOBER SAIL

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		TATA STEEL CORUS VOEST ALPINE GROBBLECH GMBH LINZ INDUSTEEL, THYSSEN KRUPP, JSPL FERROMEX, REINERBRACH AZOVSTAHL IRON & STEEL CO. WUYANG IRON & STEEL CO. LTD. DUFERCO CLABEQ, ARCELORMITTAL POSCO NIPPON STEEL, KOBE STEEL JFE ESSAR STEEL MARUBENI ITOCHU WELSPUN SWEDESH STEEL RIMJHIM ISPAT JINDAL STAINLESS LTD
1.1.11	SERVOMOTOR	BHEL BOSCH REXROTH INDIA LIMITED HYDAC (INDIA) PVT. LTD. YUKEN INDIA LIMITED HYDROSAAR GMBH,BARNIER HYDRO PACK INDIA PVT LTD RA SPECTRUM ENGG SERVICES GE TOSHIBA SALZGITTER HYDRULICS
1.1.12	SHAFT SEAL	THORDON GE BHEL ANDRITZ TOSHIBA VOITH S M SEALS
1..1.13	HP-HVOF COATING	ANDRITZ BHEL TOSHIBA VOITH GE
1.1.14	SELF LUBRICATING BUSHES	THORDON DEVA AVI OILESS RA SPECTRUM SONEJI ENGG OILES CORPORATION TENMAT LTD SUNCORE INC. LHG-GLEITLAGERKOMPONENTEN GMBH SKF

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
1.1.15	TURBINE DISCHARGE MEASURING EQUIPMENT (ULTRASONIC FLOWMETER)	RITTMEYER ACCUSONIC NIVUS KEIKI
2.0	**DIGITAL GOVERNING SYSTEM AND ACCESSORIES**	
2.1	DIGITAL GOVERNOR	BHEL, EDN TOSHIBA CORPORATION GE VOITH ANDRITZ
2.2	HYDRAULIC OVERSPEED VALVE	VICKERS (EATON) REXROTH INDIA LTD. YUKEN
2.3	SERVO/ PROPORTIONAL VALVES	BOSCH REXROTH MOOG MOTION CONTROL YUKEN EATON PARKER ATOS
2.4	PRESSURE TANK (ACCUMULATOR)	GE BHEL ANDRITZ TOSHIBA VOITH TEMASME VESELEX ISGEC HEAVY ENGINEERING HYDAC PARKER BOLENZ & SCHAEFER EPE
2.5	OIL PUMPS	TUSHACO ROTO PUMP SETS & HYDRAULICS PVT. LTD G L REXROTH DOWTY ALLWEILER IMO UT PUMPS BORNEMANN LEISTRITZ KRAL HYDAC YUKEN
2.6	OPU/ HYDAULIC POWER PACK / GOVERNOR ACTUATOR FOR GUIDE VANE	BOSCH REXROTH HYDAC YUKEN EATON-VICKERS MOOG MOTION CONTROL
3.0	**MAIN INLET VALVE AND ACCESSORIES**	
3.1	SERVOMOTOR	BHEL BOSCH REXROTH INDIA LIMITED HYDAC YUKEN

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		HYDROSAAR GMBH BARNIER HYDRO PACK RA SPECTRUM GE, TOSHIBA SALZGITTER HYDRULICS
3.2	PRESSURE TANK (ACCUMULATOR)	GE BHEL ANDRITZ TOSHIBA VOITH TEMASME VESELEX ISGEC HEAVY ENGINEERING HYDAC PARKER BOLENZ & SCHAEFER EPE
3.3	OIL PUMPS	TUSHACO ROTO GL REXROTHDOWTY ALLWEILER IMO UT PUMPS BORNEMANN LEISTRITZ KRAL HYDAC YUKEN
3.4	BY -PASS VALVE AND AIR RELEASE VALVE	INDIAN PNEUMATIC & HYDRAULIC CO ERHARD VAG HYDAC TB HYDRO
3.5	SELF LUBRICATING BUSHES	THORDON DEVA AVI OILESS RA SPECTRUM SONEJI ENGG OILES CORPORATION TENMAT LTD SUNCORE INC. LHG-GLEITLAGERKOMPONENTEN GMBH SKF
3.6	OPU/ HYDAULIC POWER PACK	BOSCH REXROTH HYDAC YUKEN EATON-VICKERS
4.0	**GENERATOR**	
4.1	**Fabrication & Manufacturing of Major Parts**	
4.1.1	STEEL PLATES	SAME AS IN TURBINE AT SR. NO. 1.1.10

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
4.1.2	STATOR CORE ELECTRICAL SHEET STEEL	JSW NIPPON ARCELOR MARUBENI ITOCHU ALLOVERGY METAL ONE CORPN. (OLD NAME-MITSUBISHI) NLMK POSCO
4.1.3	STATOR FRAME AND SOLE PLATES	SIMPLEX GTV TATA GROWTH SHOP BHEL TOSHIBA GE VOITH ANDRITZ DUNHIL PRODUCTS GLOBAL HEAVY ENGINEERING INDUSTRIES ISHAAN INDUSTRIAL CORPORATION MEHTA INDUSTRIES MODERN ALLIED INDUSTRIES SIGMA HEAVY ENGG. INDUSTRIES SHREE KUSHAL FABRICATORS MECHMEN
4.1.4	STATOR BARS	BHEL ANDRITZ ABB GE VOITH CORAL COIL INDIA PVT. LTD.
4.1.5	ROTOR RIM SHEET PUNCHING	ARCELOR ALLOVERGY THYSSEN KRUPP URJA METALLICS PVT. LTD JSW
4.1.6	ROTOR SPIDER	SIMPLEX GTV KCP BHEL TOSHIBA GE VOITH ANDRITZ TATA GROWTH SHOP DUNHIL PRODUCTS GLOBAL HEAVY ENGINEERING INDUSTRIES ISHAAN INDUSTRIAL CORPORATION MEHTA INDUSTRIES MODERN ALLIED INDUSTRIES SIGMA HEAVY ENGG. INDUSTRIES SHREE KUSHAL FABRICATORS SHRAO ENGG. WORKS
4.1.7	GENERATOR SHAFT(S)	BHARAT FORGE CO. LTD. CFFP, BHEL SUMITOMO CORPORATION

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		FOMAS MORANDINI OFAR SPA TRENTON WORKS SCANA BJOR NEBORG AB THYSEEN RHEINSTAHLTECKNIK GMBH, VOEST ALPINE IMPSA ASIA SDN BHD DOOSAN HEAVY INDUSTRIES MILL-KVAERNER IMGB SA NUOVA OFAR L&T SPECIAL STEEL AND HEAVY FORGINGS PVT. LTD.
4.1.8	UPPER AND LOWER BRACKET	SIMPLEX KCP GTV BHEL TATA GROWTH SHOP TOSHIBA GE VOITH ANDRITZ DUNHIL PRODUCTS SUGO INDUSTRIES MITUSHIBISHI ELECTRIC DUNHIL PRODUCTS GLOBAL HEAVY ENGINEERING INDUSTRIES ISHAAN INDUSTRIAL CORPORATION MEHTA INDUSTRIES MODERN ALLIED INDUSTRIES SIGMA HEAVY ENGG. INDUSTRIES SHREE KUSHAL FABRICATORS SHRAO ENGG. WORKS
4.1.9	GUIDE/THRUST BEARING	BHEL OMEGA RENK MITCHELL BEARING THE INDIA THERMIT CORPORATION LTD THORDON
4.1.10	BRAKE/JACK SYSTEM	HYDRO PACKS BEMCO HYDRAULICS ORIENTAL ENGG. WORKS
4.1.11	AIR AND OIL COOLERS	KARNATKA ENGG LAXMI ENGG PATEL ENGG MANISH UDYOG SHRAO ENGG. WORKS
5	**INSTRUMENTS AND DEVICES common for turbine, generator, MIV, and Governor**	
5.1	MERCURY / GAS IN STEEL THERMOMETERS (DTT)	BUDENBERG KOBOLD ASHCROFT DRESSER EUROPE GMBH PRECISION MASS PRODUCTS (P) LTD WIKA

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
5.2	PRESSURE SWITCH	HYDAC BOSCH REXROTH LTD. WIKA KOBOLD BARKSDALE ASHCROFT BAUMER
5.3	FLOW RELAY AND FLOW METER	ENDRESS+ HAUSER FISHER ROSEMOUNT EMERSON PROCESS MGT. ABB YOKOGAWA GE) KROHNE MARSHALL NIVO CONTROLS
5.4	PRESSURE TRANSMITTERS	ENDRESS + HAUSER YOKOGAWA FISHER ROSEMOUNT PVT. LTD. EMERSON PROCESS MGT. HONEYWELL HART
5.5	THERMOSTATS	DANFOSS SEIMENS HONEYWELL INDFOS INDUSTRIES PVT. LTD. WIKA
5.6	SHAFT CURRENT MONITORS	BHEL ABB
5.7	VIBRATION MONITORING SYSTEM	VIBRO SYSTEM BRUEL AND KJAER SHINKAWA ELECTRIC CO.LTD. GE (BENTLEY NEVADA) MC MONITORING LAGGE TECHNOLOGIES LOGIC PLUS PLUS IRD MECHANALYSIS FORBES MARSHALL IRIS
5.8	MOISTURE DETECTOR	GEENDRESS + HAUSER VAISALA ROBERTSHAW ONIX INSTRUMENTS MAPE NEDERMAN SART
5.9	BEARING OIL (FOR TURBINE AND GENERATOR)	INDIAN OIL CORPORATION LTD. CASTROL INDIA LTD. BHARAT PETROLEUM LTD. HINDUSTAN PETROLEUM LTD.
5.10	FIRE PROTECTION SYSTEM	TECHNICO NEW FIRE ENGINEERS NEWAGE FIRE PROTECTION ENGINEERS PVT LTD ELEVEN CONSTRUCTION PVT LTD
5.11	PARTIAL DISCHARGE MONITOR SYSTEM	IRIS EATON

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		FRS PDTECH MC MONITORING
5.12	AIR GAP MONITOR SYSTEM	VIBRO SYSTEM IRD MECHANLYSIS GE (BENTLEY NEVADA) MC MONITORING MAGGIT IRIS
6.0	**STATIC EXCITATION SYSTEM**	GE BHEL TOSHIBA CORPORATION ABB ANDRITZ VOITH
6.1	DRY TYPE EXCITATION TRANSFORMER	BHEL CGL GE ABB VOLTAMP EMCO,RAYCHEM,TOSHIBA,KEC,AMEX IMPEX, HAMMAND POWER SOL OCREV
7.0	**BUS DUCT**	BHEL C&S POWER GEAR REEP INDUSTRIES
7.1	CURRENT TRANSFORMER	PRAYOG ELECT PRAGATI SILKAANS KAPPA AE MEHRU
7.2	POTENTIAL TRANSFORMER	PRAYOG ELECT. PRAGATI SILKAANSAE KAPPA MEHRU
7.3	LIGHTENING / SURGE ARRESTOR	ELPRO OBLUM LAMCO
7.4	NEUTRAL GROUNDING TRANSFORMER	PRAGATI PRAYOG ELECT
7.5	PROCELAIN INSULATORS	BHEL W S INDUSTRIES INDIA LTD ADITYA BIRLA INSULATORS MODERN INSULATOR LTD
7.6	EPOXY INSULATORS/ EPOXY SEAL OFF BUSHING	BARODA BUSHING & INSULATOR BARODA MOULD & DIES INDIA INSULATOR A-BOND STRANDS TEXPLAS

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
7.7	SURGE CAPACITOR	MADHAV CAPACITOR SHAKTI CAPACITOR , MAGANWINE ABB
8.0	**GSU TRANSFORMERS**	BHEL GE CGL TELK ABB TOSHIBA HITACHI SIEMENS
8.1	AUTO POWER TRANSFORMERS	
8.2	STATION TRANSFORMERS	
8.3	OIL PUMPS	FLOWWELL SULZER GEA BEST & CROMPTON
8.4	DOUBLE WALLED OIL COOLERS	KELVION BLOKSMA NETHERLAND GEI HAMON BHEL TADA ELECTRIC COMPANY POSITRON ENGINEERING CO
8.5	BUSHINGS	BHEL CGL GE GRID SOL ABB ADITYA BIRLA INSULATORS PVT. LTD. JAYSHREE INSULATOR MODERN INSULATOR HSP (HOCHSPANNUNGSGERATE PORZ) GMBH, TRENCH OBLUM
8.6	TRANSFORMER OIL	SAVITA OIL TECHNOLOGIES SAVITA CHEMICALS INDIA LTD APAR INDUSTRIES RAJ PETROCHEMICALS NYNAS NOPTHENICS INDIA
8.7	BUCHHOLZ RELAY	ATVUS SUKRUT ELECTRIC
8.8	OTI / WTI (MICRO SWITCH TYPE)	PRECIMEASURE PERFECT CONTROLS
8.9	MAGNETIC OIL LEVEL GAUGE (MOLG)	SUKRUT UDYOG YOGYA ENTERPRISES ATVUS
8.10	PRESSURE RELIEF DEVICE	SUKRUT UDYOG
8.11	AIRCELL	SUKRUT UNIRUB
8.12	NITROGEN INJECTION SYSTEM	GK POWER TRANSMISSION COMPANY PVT. LTD. SERGI CTR EASUN-MR

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
8.13	MOISTURE DETECTOR (WATER IN OIL DETECTOR)	BHEL GE ROBERTSHAW ONIX INSTRUMENTS MAPE NEDERMAN SART VAISALA ENDRESS+HAUSER GR SCIENTIFIC
8.14	DGA	GE-KELMAN ESCO TECHNOLOGIES INC.(FORMERLY MORGAN SCHAFFER)
8.15	PORTABLE RELATIVE OIL SATURATION	B&K PRECISION VAISALA EXTECH INSTUMENTS VAISESHIKA DOBLE ENGINEERING
9.0	**BUS /LINE REACTOR**	BHEL SIEMENS T&R GE CGL TELK ABB TOSHIBA
10.0	**400 /220kV XLPE Cables**	SUDKABEL SAGEM SA NEXANS J POWER SYSTEMS CORPORATION BRUGG KABEL, AG, VISCAS CORPORATION(EARLIER FUJIKARA LTD, LS CABLE PIRELLI ABB TAIHAN ILJIN KEI UNIVERSAL
11	**420 /245 kV GIS**	ABB HITACHI TOSHIBA SIEMENS GE VERNOVA HYOSUNG
12	**OUTDOOR POTHEAD YARD EQUIPMENT-**	
12.1	CAPACITIVE VOLTAGE TRANSFORMER	ABB BHEL GE CGL ELPRO
12.2	LA/SURGE ARRESTER	CGL ELPRO LAMCO

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		ABB GE OBLUM WSI
12.3	LINE/ WAVE TRAP	ABB BHEL BPL TRENCH ELECTRIC GE
12.4	CONDUCTOR	STERLITE INDUSTRIES (I) LTD APAR INDUSTRIES LTD. HINDUSTHAN VIDYUT PRODUCTS LTD. RAMSARUP INDUSTRIAL CORPN. USHA MARTIN INDUSTRIES TATA IRON & STEEL COMPANY LIMITED – WIRE DIVISION KATARIA INDUSTRIES PVT. LTD. BAJRANG WIRES PRODUCTS (I) PVT. LIMITED, BEDMUTHA WIRES COM. LIMITED
12.5	POST INSULATOR / INSULATOR STACK	BHEL ADITYA BIRLA INSULATOR PVT LTD MODERN INSULATORS LTD
12.6	STRUCTURE	JYOTI STRUCTURE AV FORGING GKW UTKAL SUJANA TOWERS LIMITED KEC L&T ECC MENGI STEEL PRODUCTS SALASAR TECHNO ENGG.
13.0	**OUTDOOR SWITCHYARD EQUIPMENTS**	
13.1	CIRCUIT BREAKER	ABB TOSHIBA SIEMENS GE
13.2	ISOLATORS / EARTH SWITCHES	ABB TOSHIBA SIEMENS GE
13.3	CURRENT TRANSFORMERS	PRAYOG ELECT PRAGATI SILKAANS KAPPA AE

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
13.4	LINE/WAVE TRAP	ABB BHEL BPL TRENCH ELECTRIC GE
13.5	CAPACITIVE VOLTAGE TRANSFORMER	ABB BHEL GECGL ELPRO
13.6	L. A./ SURGE ARRESTER	CGL ELPRO LAMCO ABB GE OBLUM WSI
13.7	CONDUCTOR	EMI TRANSMISSION LTD., INTERNATIONAL TRANSMISSION LINE PRODUCTS PVT. LTD., TAG CORPORATION, ASBESCO INDIA PVT. LTD., RASHTRAUDHYOG LTD. EMC LTD.,
14	**DC SYSTEM INTEGERATOR**	AMARARAJA EXIDE HBL POWER SYSTEMS AMCO CHLORIDE POWER CHHABI ELECTRICALS STATCON DUBAS VERTIV
14.1	BATTERY BANKS	AMARARAJA EXIDE HBL POWER SYSTEMS AMCO SAFT INDIA
14.2	BATTERY CHARGER	HBL POWER SYSTEMS AMARARAJA STATCON CHHABI CHLORIDE SIEMENS CALDYNE DB ELECTRONICS APLAB DUBAS VERTIV
14.3	DC DISTRIBUTION BOARD	SIEMENS SCHNEIDER L&T GE C&S ELPRO GEMCO

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		STATCON CALDYNE DB ELECTRONICS VERTIV
14.4	UPS/ INVERTER	EMERSON NETWORK POWER (previously TATA LIEBERT AMARARAJA HBL POWER SYSTEMS LIMITED ,DUBAS MASSTECH CONTROLS PVT LTD DB ELECTRONICS VERTIV DUBAS
15	**CONTROL AND MONITORING SYSTEM**	
15.1	CONTROL AND MONITORING SYSTEM	GE BHEL TOSHIBA CORPORATION ABB ANDRITZ VOITH SIEMENS
15.2	PANELS / CUBICLES / CONTROL BOARDS	RITTAL TRICOLITE SIEMENS ABB BHEL ANDRITZ GE PYROTECH C&S ELECTRIC
15.3	LED DISPLAY	SAMSUNG LG TOSHIBA SONY PANASONIC BARCO CHISTIE PLANAR PYROTECH
15.4	HMI	HP IBM DELL COMPAQ GE FANUC
15.5	SERVERS	HP IBM DELL COMPAQ 3-COM SUN MICRO SYSTEM
15.6	PLCS	GE FANUC MAX DNA DPU 4F ALLAN BRADLEY

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		ROCKWELL SIEMENS TOSHIBA
15.7	NETWORK COMPONENTS	CISCO 3-COM PHOENIX SUN MICRO SYSTEM HIRSCHMANN MOXA
15.8	WORKSTATIONS/ COMPUTERS/ PC/ LAPTOP & OTHER ACCESSOIRIES	HP IBM DELL SUN MICRO SYSTEM TOSHIBA
16	**PROTECTION SYSTEM**	
16.1	PROTECTION SYSTEM	ABB BHEL GE SIEMENS VOITH ANDRITZ
16.2	NUMERICAL RELAYS	ABB GE ANDRITZ SIEMENS SEL SCHNEIDER
16.3	PANELS / CUBICLES / CONTROL BOARDS	RITTAL TRICOLITE SIEMENS ABB BHEL ANDRITZ HYDRO GE PYROTECH
16.4	STATIC / ELECTRO-MECHANICAL PROTECTION / AUXILIARY / TRIIPNG RELAYS	ABB GE ANDRITZ SIEMENS TELEMECANIQUE SCHNEIDER GUARDIAN FINDER L&T PHOENIX BENDER JYOTI
16.5	AUXILARY CT/ PT	PRAYOG ELECTRICALS(P) LTD PRAGATI ELECTRICALS PVT LTD SILKAANS ELECTRICALS MFG. CO.PVT. LTD AE KAPPA NEWTEK

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
17	**CABLING SYSTEM**	
17.1	LT POWER CABLES	CCI UNIVERSAL KEI POLYCAB INCAB NICCO TORRENT KEC HAVELLS DELTON
17.2	11KV XLPE CABLE	CCI UNIVERSAL POLYCAB INCAB NICCO TORRENT KEC NEXAN HAVELLS DELTON
17.3	CONTROL CABLES	HAVELLS UNIVERSAL POLYCAB FINOLEX NICCO CCI KEI TORRENT INCAB DELTON LAPP KEC
17.4	INSTRUMENTATION CABLES	UNIVERSAL POLYCAB FINOLEX NICCO CCI KEI DELTON TORRENT LAPP KEC HAVELLS
17.5	CABLE TRAYS, RACKS INCLUDING ACCESSORIES	VENUS PROFAB STEELITE INDIANA GLOBE ELECTRICAL IND PVT LTD RATTAN ENG COMP PVT LTD PATNY PREMIER STEEL & GALVANIZERS PVT LTD
18	**MV SWITCHGEAR**	

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
18.1	11 KV VACUUM CIRCUIT BREAKER	BHARAT ELECTRONICS LTD. EATON ELECTRICAL INC. SIEMENS SCHNEIDER CGL ABB L&T C&S ELECTRIC LTD. AREVA-GE GE ANDREW YULE
18.2	MV SWITCHGEAR	BHEL SIEMENS ABB KEC CGL ANDREW YULE CONTROL & SWITCHGEAR GE S&S POWER SWITCHGEAR SCHNEIDER L&T
18.3	STATION AUIXLARY TRANSFORMER	BHEL VOLTAMP CGL KANOHAR MIRZAPUR ELECTRICALS ANDREW YULE KEC GE AMES IMPEX KPE LG ABB
18.4	CT/PT	PRAYOG ELECTRICAL (P) LTD. PRAGATI ELECTRICALS PVT. LTD. SILKAANS ELECT. MFG.CO.PVT.LTD. AE ,CGL,ABB,GE KAPPA NEWTEK MEHRU ELECTRICALS & MECH ENGINEERS
18.5	PANELS/ CUBICLES	SIEMENS SCHNEIDER CGL L&T ABB GE RITTAL PYROTECH BCH C&S ELECTRIC LTD.
18.6	NUMERICAL RELAY	ABB GE SIEMENS ANDRITZ

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		L&T SEL SCHNEIDER
18.7	PROTECTION RELAY / AUXILIARY RELAY	ABB GE SIEMENS ANDRITZ L&T SEL SCHNEIDER
19	**DG SETS**	
19.1	MANUFACTURER / INTEGRATOR	JAKSON CUMMINS TIL POWERICA CATERPILLAR GMMCO SUDHIR GREAVES WARTSILA KIRLOSKAR OIL ENGINES SUPERNOVA ENGINEERS LTD STERLING GENERATORS PVT. LTD
19.2	ENGINE	CATERPILLAR CUMMINS WATERSILA MAN KOEL PERKINS
19.3	ALTERNATOR	CGL LEROY SOMER KIRLOSKAR STAMFORD AVK TOYO DENKI
20	**415 V SWITCHGEAR AND AUXILIARY TRANSFORMERS**	
20.1	UABS/ SABS/415V SWITCHGEAR PANELS	SIEMENS PYROTECH SCHNEIDER CGL L&T ABB GE HAVELLS C&S BCH
20.2	UAT,SST,AUXILIARY TRANSFORMER ETC.	BHEL VOLTAMP CGL KANOHAR MIRZAPUR ELECTRICALS ANDREW YULE KEC GE AMES IMPEX

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		KPE LG ABB
20.3	CT/PT	PRAYOG ELECTRICAL (P) LTD. PRAGATI ELECTRICALS PVT. LTD. SILKAANS ELECT. MFG.CO.PVT.LTD. AE KAPPA NEWTEK
20.4	PANELS/ CUBICLES	SIEMENS SCHNEIDER CGL L&T ABB GE HAVELLS RITTAL PYROTECH BCH C&S ELECTRIC LTD.
20.5	NUMERICAL RELAY	ABB GE ANDRITZ SIEMENS SEL SCHNEIDER L&T
20.6	PROTECTION RELAY / AUXILIARY RELAY	ABB GE SIEMENS SCHNEIDER SEL TELEMECANIQUE SCHNEIDER GUARDIAN FINDER L&T PHOENIX JYOTI
20.7	LV BUS DUCT	SIEMENS / C&S ELECTRIC LTD / ABB / ENTRACO / ALFA TECHNOLOGIES PVT. LTD
21	**ILLUMINATION SYSTEM**	
21.1	ILLUMINATION SYSTEM INTEGRATOR	PHILIPS CGL GE ABB PHOENIX AVAIDS TECHNOLOGIES LTD. MIKA BAJAJ WIPRO ECE

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
21.2	ILLUMINARIES / FITTINGS	PHILIPS CGL GE BAJAJ ELECTRICAL LTD. WIPRO HAVELLS SYSKA
21.3	MODULAR SWITCHES/SOCKETS	PHILIPS SCHNEIDER HAVELLS LEGRAND ABB CGL GE
21.4	CIRCUIT BREAKER/MCB/MCCBS	SIEMENS SCHNEIDER CGL ABB L&T C&S HAVELLS
21.5	POWER CABLES	CCI UNIVERSAL KEI POLYCAB INCAB RADIANT NICCO TORRENT HAVELLS KEC
21.6	CONTROL CABLES & WIRES	HAVELLS UNIVERSAL POLYCAB FINOLEX NICCO CCI KEI TORRENT INCAB KEC LAPP DELTON
21.7	UPS/ INVERTER	EMERSON NETWORK POWER (previously TATA LIEBERT) AMARARAJA HBL POWER SYSTEMS LIMITED DUBAS MASSTECH CONTROLS PVT LTD DB ELECTRONICS VERTIV
22	**COMMUNICATION SYSTEM**	
22.1	PA SYSTEM	
22.1.1	PUBLIC ADDRESS SYSTEM	PHILIPS

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
	MAKE	BOSCH BPL ITI ECIL BNA TECHNOLOGIES GAI-TRONICS COMMTEL AHUJA E SQUARE
22.1.2	PUBLIC ADDRESS SYSTEM INTEGRATOR	HARITASA ZICOM ELECTRONICS AND SECURITY SYSTEMS HONEYWELL AUTOMATION DANLAW TECHNOLOGIES INDIA LTD.- TOSHNIWAL INDUSTRIES COMMTEL BNA TECHNOLOGIES
22.1.3	EPABX	PANASONIC SIEMENS CANON BPL MATRIX ALCATEL BOSCH CROMPTON TATA
22.1.4	CONFERENCING SYSTEM	PANASONIC SIEMENS CANON BPL BOSCH
23	**ELECTRICAL WORKSHOP**	
23.1	AC / DC INSULATION RESISTEANCE TESTER	MEGGER FLUKE
23.2	DIGITAL MULTIMETERS FOR AC & DC	FLUKE YOKOGAWA MEGGER
23.3	SINGLE PHASE / THREE PHASE TOROIDAL TRANSFORMERS	AE
23.4	PORTABLE MULTI-CHANNEL VIBRATION METER	HTC INSTRUMENTS ABRO (KOSHA) BASELINE EXTECH
23.5	PORTABLE EARTH RESISTANCE MEASURING DEVICE	MEGGER
23.6	STROBOSCOPE	HTC INSTRUMENTS SHIMPO CHECKLINE
23.7	DIGITAL PORTABLE DUAL BEAM CATHODE RAY OSCILLOSCOPE FOR CHOPPED & ALTERNATIVE OPERATION MODE	TEKTRONIX

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
23.8	PORTABLE TYPE MICRO OHM METER	MEGGER CROPICO MEGABRAS RAYTECH AEMC
23.9	DC EARTH FAULT LOCATOR	MEGGER EUMAC SALUMBERGSS
23.10	**TESTING DEVICES**	
23.10.1	HV-AC TEST SET	MEGGER BAUR SEBA KMT T & R PHOENIX TECH ETM
23.10.2	TRANSFORMER DC WINDING RESISTANCE MEASUREMENT TEST KIT	MEGGER SCOPE T & M TINSLEY
23.10.3	PRIMARY CURRENT INJECTION KIT	GE PROGRAMMA ISA SCOPE T & M
23.10.4	PORTABLE MICROPROCESSOR BASED NUMERICAL RELAY TESTING EQUIPMENT FOR CHECKING THE ACCURACY OF ALL THE TYPE OF RELAYS E.G DISTANCE RELAYS,DIFFERENTIAL CURRENT RELAYS,VOLTAGE RELAYS,TIMERS,DEFINITE & INVERSE TYPE OVER-CURRENT RELAYS	OMICRON MEGGER ISA
23.10.5	DC RECTIFORMER OF SUITABLE RATING FOR DRYING OUT GENERATOR WINDING COMPLETELY	AE RE
23.10.6	DEW POINT METER	BK PRECISION VAISALA EXTECH VAISESHIKA
23.10.7	CIRCUIT BREAKER TIMING MEASUREMENT ANALYSER	GE PROGRAMMA MEGGER EGIL OR SCOPE T & M SCOT MXP ISA
23.10.8	AUTOMATIC TURNS RATIO TESTER (THREE PHASE) / TRANSFORMER TURNS RATIO METER	MEGGER TINSLEY

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
23.10.9	AUTOMATIC CAPACITANCE & TAN DELTA KIT	MEGGER HAEFLEY HIPTRONICS TETTEX INST. OMICRON ISA
23.10.10	UNIVERSAL RELAY TESTING KIT	OMICRON MEGGER
23.10.11	**TRANSFORMER OIL TESTING DEVICES**	
23.10.11.1	TRANSFORMER OIL DIELECTRIC TESTER	BAUR, MEGGER
23.10.11.2	OIL MOISTURE MEASUREMENT KIT	MEGGER, VEEGO
23.10.11.3	RESISTIVITY MEASUREMENT KIT	MEGGER BAUR VEEGO
24	**EOT CRANE**	
24.1	EOT CRANES	MUKAND KONE(WMI) ANUPAM TATA GROWTH SHOP FAFECO UNIQUE
	(For 5/10T EOT)	AVON AUTOMECH REVA CRANEX J D HOIST
24.2	VVVF DRIVE AND CONTROL	L&T YOKOGAWA ABB SIEMENS SCHNEIDER
24.3	WIRE & ROPES	USHA MARTIN FORT WILLIAM
24.4	MOTOR	ABB GEKEC CGL BBL SIEMENS JYOTI NGEF
25	**COOLING WATER SYSTEM**	
25.1	CENTRIFUGAL PUMPS	KBL JYOTI BEST & CROMPTON WILO MATHER & PLATT PUMPS PVT. LTD KSB PUMPS LTD FAIR BANK MORSE

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		FLOWMORE GRUNDFOS XYLEM (FLYGT) SULZER (ABS) MODY WPIL
25.2	VERTICAL INLINE PUMPS	XYLEM (FLYGT) KSB PUMPS LTD WILO GRUNDFOS, INDIA KBL
25.3	FILTERS / DUPLEX STRAINERS	FILTERATION ENGINEERS PVT. LTD. MULTITEX-FILTRATION ENGINEERS HYDAC BOLL & KIRCH FILTERS SUPERFLO FILTER PVT LTD TIMEX
25.4	CYCLONE SEPERATOR	LAKOS YARDNEY SANKYO KRESB ENGRS FILTERATION ENGINEERS PVT. LTD. TIMEX SUPERFLO FILTERS PVT. LTD
25.5	HEAT EXCHANGER	ALFA LAVAL ULTRAMIX KELVION L&T BHEL IDMC TRANTER
26	**DRAINAGE AND DEWATERING SYSTEM**	
26.1	SUBMERSIBLE PUMPS	XYLEM (FLYGT) GRUNDFOS SULZER (ABS) KBL KSB AQUA MACHINERIES PVT LTD
27	**HVAC SYSTEM**	
27.1	HVAC SYSTEM INTEGRATOR	KIRLOSKAR PNEUMATICS BLUE STAR LTD. VOLTAS LTD. CARRIER AIRCON LTD. FEEDERS LLOYD S K SYSTEMS PVT LTD. STERLING WILSON C-DOC BATLIBOI LTD ROOTS COOLING SYSTEMS PVT. LTD
27.2	PACKAGED AC (WATER COOLED/AIR COOLED)	YORK TRANE CARRIER BLUE STAR VOLTAS

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		HITACHI
27.3	BLOWERS / FAN	DUVENT NADI C-DOC KIRLOSKAR BLUE STAR VOLTAS ABB CARRIER FLAKT GE KURGER NICOTRA
27.4	EXHAUST FAN	GE FLAKT ABB KRUGER NICOTRA NADI
27.5	AHU's	KIRLOSKAR PNEUMATICS BLUE STAR LTD. VOLTAS LTD. CARRIER ABB CARYAIRE SYSTEMAIR ZECO AIRCON INDUSTRIES PVT. LTD.
27.6	PUMPS, STRAINER AND CYCLONE SEPARATOR	AS PER COOLING WATER SYSTEM AT 25.1, 25.2 & 25.3
28	**COMPRESSED AIR SYSTEMS**	
28.1	COMPRESSOR	ELGI EQUIPMENTS LTD. ELGI SAUER INGERSOL RAND (INDIA) LTD. KIRLOSKAR PNEUMATICS ATLAS CAPCO COMPAIR BELLISS & MORCOM KAJIIRON WORKS LTD MIKUNI KIKAI KOGYA CO. LTD TOSHIBA GARDNER DENVER CHICAGO PNEUMATICS KOGYO CO. LTD GARDNER SAUER VYAAN EQUIPMENTS INDIA PVT LTD COMPTECH EQUIPMENTS PVT LTD
28.2	AIR DRYER	SUMMIT TRIDENT GEM EQUIPMENTS PVT. LTD. INGERSOLL ELGI
29	**FIRE FIGHTING SYSTEM**	
29.1	FIRE FIGHTING SYSTEM INTEGRATOR	UNITECH MACHINES VIJAY TECHNOFAB

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		MATHER & PLATT FIRE SYSTEMS TECHNICO STEELAGE FIRE SAFETY DEVICES NEW FIRE ENGINEERS PRAGATI BHARTI FIRE ENGINEERS HD FIRE PROTECT PRIVATE LTD. ZENITH FIRE SERVICES INDIA PVT. LTD. AGNICE FIRE PROTECTION AGNI CONTROL ENGINEERS NEWAGE FIRE PROTECTION ENGINEERS PVT LTD ELEVEN CONSTRUCTION PVT LTD
29.2	DETECTION INSTRUMENTS	DETECTION INSTRUMENTS NOTIFIER V AUTOMAT NEW AGE INDUSTRIES HD FIRE PROTECT PRIVATE LTD ZENITH FIRE SERVICES INDIA PVT LTD AGNICE FIRE PROTECTION AECC HI TECH ACCURATE UNISAFE AGNI CONTROL ENGINEERS KIDDE PATOL EDWARDS SYSTEMS TECH XTRALIS SYSTEM SENSOR FENWAL APOLLO ZITON PYROTRONICS HONEYWELL SECURITON
29.3	PUMP/MOTOR SET	MATHER & PLATT VOLTAS CGL BEACONWEIR KIRLOSKAR WPIL
29.4	PORTABLE FIRE EXTINGUISHERS	VIJAY SAFEX ZENITH BHARTI FIRE ENGINEERS MINIMAX LIGHTEX NITIN
29.5	FIRE ALARM PANEL	JOHNSON CONTROL ZITON NOTIFIER SECURITON SYSTEM SENSORS HONEYWELL

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		EDWARD
29.6	FILTER/ STRAINER	AS PER COOLING WATER SYSTEM AT 25.2
30	**OIL HANDLING SYSTEM**	
30.1	LUBRICATING OIL SYSTEM	ALFA LAVAL FOWLER WESTRUP INDIA PVT. LTD. VPI PENNWALT TOYO YUKI Co. Ltd. CBS TECHNOLOGY PVT. LTD. ENERVAC
30.2	INSULATING OIL SYSTEM	SUMESH PETROLEUM ALFA LAVAL FOWLER WESTRUP INDIA PVT. LTD. VPI PENNWALT TOYO YUKI Co. Ltd. CBS TECHNOLOGY PVT. LTD.
30.3	PUMPS	SHINKO SEIKI TUTHIL TUSHACO KBL TOTODEL FLOWWELL JYOTI DOWTY
30.4	VACUUM PUMPS	SHINKO SEIKI BUSCH VACUUM LEYBOLD TUTHILL
30.5	CENTRIFUGE	ALFA LAVAL GEA WEST FALIA SEPARATOR
31	**MECHANICAL WORKSHOP**	
31.1	ELECTRICAL HAND DRILLING MACHINE	HITACHI BOSCHMETABO RALLIWOLF
31.2	UNIVERSAL TYPE RADIAL DRILLING MACHINE	BATLIBOI HMT NAGMATI EIFCO ATLAS
31.3	PORTABLE MAGNETIC BASE ELECTRICAL DRILLING MACHINE	HITACHI BOSCH METABO
31.4	LONG LATHE	BATLIBOI HMT NAGMATI ATLAS
31.5	SHORT LATHE	BATLIBOI HMT NAGMATI

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		ATLAS
31.6	UNIVERSAL MILLING MACHINE	BATLIBOI HMT NAGMATI SAGAR
31.7	SHAPER MACHINE	BATLIBOI HMT ATLAS SAGAR
31.8	DOUBLE ENDED GRINDING MACHINE	BATLIBOI EIFCO NAGMATI ELMACO
31.9	POWER HACKSAW	KASTO EIFCO SAGAR
31.10	RECTIFIER TYPE WELDING MACHINE	ADOR ESAB L & T STERCO NATIONAL PANASONIC
31.11	WELDING GENERATORS	ADOR ESAB L & T STERCO NATIONAL PANASONIC
31.12	PIPE BENDING MACHINE	HYDROBEND HMT BATLIBOI ATLAS INDER
31.13	BATTERY OPERATED FORK LIFTER	GODREJ VOLTAS JOST
31.14	BATTERY OPERATED HANDLING CART	GODREJ VOLTAS JOST
31.15	HYDRAULIC PLATFORM	GODREJ VOLTAS JOST MAHINDRA STILLER ANNAPURNA TROLLEYS
31.16	PRECISION INSTRUMENTS • VERNIER CALLIPER • DIAL GAUGE • HEIGHT GAUGE • STRAIGHT EDGE • SCREW GAUGE • MASTER LEVEL • OPTICAL LEVEL • DEPTH GAUGE • INSIDE AND OUTSIDE	MITUTOYO BOSCH

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
	MICRO METER • SURFACE PLATE	
32	**ELEVATOR**	Subcontractor/sub vendor shall be decided during detail engineering by the Employer.
32.1	WIRE ROPE	USHA MARTIN FORT WILLIAM
33	**SECURITY AND SURVEILLANCE SYSTEM**	
33.1	SECURITY AND SURVEILLANCE SYSTEM (INTEGERATOR)	PELCO HONEYWELL VICON PHILIPS HID CORPORATION NORTHERN COMPUTERS INC LENEL SYSTEMS INTERNATIONAL INC, TATA HONEWELL ZICOM ELECTRONICS DATS ALBA CONTROL TOSHNIWAL GROUP4 JOHNSON CONTROL
33.2	ACCESS CONTROL SYSTEM	DATS GROUP4 HONEYWELL JOHNSON CONTROL TATA HONEYWELL PELCO VICON PHILIPS HID CORPORATION NORTHERN COMPUTERS INC LENEL SYSTEMS INTERNATIONALS INC
33.3	CCTV SURVELLIANCE SYSTEM	DATS GROUP4 HONEYWELL JOHNSON CONTROL TATA HONEYWELL PELCO VICON PHILIPS HID CORPORATION NORTHERN COMPUTERS INC LENEL SYSTEMS INTERNATIONALS INC
34	**MISCELLANEOUS ITEMS**	
34.1	MOTORS	KIRLOSKAR CGL ABB NGEF SIEMENS GE BBL KEC

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		JYOTI
34.2	CT & PT	PRAYOG ELECTRICAL (P) LTD. PRAGATI ELECTRICALS PVT. LTD. SILKAANS ELECT. MFG.CO.PVT.LTD. AE KAPPA
34.3	NUMERICAL RELAY	ABB GEANDRITZ SIEMENS SEL SCHNEIDER L&T
34.4	STATIC / ELECTRO-MECHANICAL PROTECTION / AUXILIARY / TRIIPNG RELAYS	ABB GE SIEMENS SCHNEIDER SEL TELEMECANIQUE SCHNEIDER GUARDIAN FINDER L&T PHOENIX
34.5	CIRCUIT BREAKERS/ MCBs/ MCCBs	SIEMENS SCHNEIDER ABB L&T C&S HAVELLS
34.6	PANELS/ CUBICLES/ CONTROL BOARDS	SIEMENS SCHNEIDER CGL L&T ABB GE HAVELLS RITTAL PYROTECH BCH C&S.
34.7	TERMINAL BLOCKS & ACCESSORIES, SIDE CLAMPS	PHOENIX WAGO AND CONTROLS (INDIA) LTD. ELMAX CONNECTWELL
34.8	STARTERS & CONTACTORS	SIEMENS ABB L&T C&S SCHNEIDER HAVELLS
34.9	TRIP CIRCUIT SUPERVISION RELAY	GE ABB

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
34.10	MOTOR PROTECTION CKT BREAKERS	SCHNEIDER ELECTRIC ABB SIEMENS LTD. CROMPTON GREAVES LTD. LEGRANDE L&T C&S
34.11	VALVES – AIR TYPE	BHEL LEVCON VALVES PVT. LIMITED LEADER VALVES LIMITED LARSON & TOUBRO AUDCO INDIA LTD. FOURESS ENGINEERING TYCO KEYSTONE HERION FLUIDTRONIC WEIR BDK KSB
34.12	VALVES – OIL TYPE	BHEL VICKERS (EATON) REXROTH TYCO YUKEN MOOG CONTROL LTD EMERSON AUDCO INDIA LTD MANNESMANN REXROTH KSBWANDFLUH WEIR BDK HYDAC L&T VALVES LHA FLOW TECH MHA ZENTGRAF STAUFF
34.13	VALVES – WATER TYPE	BHEL LEVCON VALVES PVT. LIMITED LEADER VALVES LIMITED L&T AUDCO INDIA LTD. EMERSONTYCO FOURESS ENGINEERING GLENFIELD & KENNEDY WEIR BDK KSB VELAN
34.14	HEAD RACE AND TAIL RACE LEVEL SENSORS AND INDICATORS	ENDRESS + HAUSER EMERSON PROCESS GEMS SENSORS AND CONTROLS
34.15	PRESSURE GAUGE	WIKA INSTRUMENTS (I) PVT LTD WAREE ASHCROFT FORBESS MARSHAL BUDENBERG GAUGE CO., TOSHNIWAL BOURDON

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		MANOMETER INDIA PVT. LTD
34.16	PRESSURE SWITCH/ PRESSURE TRANSMITTER	HYDAC BOSCH REXROTH WIKA INSTRUMENTS PVT. LTD KOBOLD BARKSDALE ASHCROFT
34.17	LEVEL SWICTH/ INDICATOR	HYDAC WIKA NIVO CONTROL SWITZER ENDRESS + HAUSER EMERSON PROCESS GEMS SENSORS AND CONTROLS OMEGA KOBOLD BARKSDALE BOSCH REXROTH NIVELCO IPARI ELEKTRONIKA ZRT
34.18	HORIZONTAL CENTRIFUGAL PUMPS	JYOTI BEST & CROMPTON WILO MATHER & PLATT PUMPS PVT. LTD) KSB PUMPS LTD FAIR BANK MORSE FLOWMORE GRUNDFOS, INDIA XYLEM (FLYGT) SULZER BEACONWEIR MODY WPIL
34.19	TEMPERATURE SENSING DEVICES/DTT	BUDENBERG KOBOLD ASHCROFT DRESSER EUROPE GMBH WIKA INSTRUMENTS(I) PVT LTD
34.20	THERMOSTATS	DANFOSS SEIMENS HONEYWELL INDFOSS INDUSTRIES WIKA
34.21	FLOW RELAY AND FLOW METER	ENDRESS+ HAUSER FISHER ROSEMOUNT EMERSON PROCESS MGT. ABB YOKOGAWA GEKROHNE MARSHALL NIVO CONTROLS
35	**LIST OF AGENCIES:**	
35.1	ERECTION / INSTALLATION SERVICES	MAHATI PES

S. No.	Items of Facilities	Names of Vendors based on already approved in earlier NHPC's Projects
		L&T ECC FITWELL PURVANCHAL UB ENGG K.K. INDUSTRIES

Note :

1. **Vendor/Sub-Contractor need to invariably comply with detailed technical specification covered in GTR, GTS and PTS.**
2. **Name of the foreign brand, foreign subcontractor/vendor appearing against any item in Attachment-5A- List of approved subcontractors/vendors (except who are eligible under the "Make in India policy) stands deleted.**

ATTACHMENT-5B

B: SPECIFIC QUALIFICATION CRITERIA FOR SUB CONTRACTORS / VENDORS PROPOSED BY THE BIDDER

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
1.0	**TURBINE AND ACCESSORIES**			
1.1	**Fabrication & Manufacturing of Major Parts of Turbine**			
1.1.1	SPIRAL CASING/ STAY RING/ TOP COVER / BOTTOM RING / DRAFT TUBE CONE			The Contractor/Sub-contractor/vendor: i) Should have manufactured/executed *similar items/works* earlier during the last Twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units or at minimum one (1) Installation of at least four units. **or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				one(1) Hydro Power Station/ Pump Storage Plant / Lift irrigation scheme of at least four units and the same shall be certified by ordering agency, in case of fabrication, forging & casting firms. In case of spiral casing, *Spiral Pressure Testing acceptance report* shall also be certified by ordering agency. **Note: If Contractor/ Sub-contractor/ vendor meets the above Specific Qualification Criteria for "Stay ring (i.e. complete all parts together)", the said Sub-contractor/vendor shall be deemed to qualify Specific Qualification Criteria for other items i.e. Bottom Ring, Top cover, and Draft tube cone.** iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project. In all cases the main contractor has to certify the veracity of correctness of document that is being claimed. Note: 1. 'Similar item/work' is defined as 50% of (Dia. x Weight) of component of prototype turbine or higher. 2. The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
1.1.2	TURBINE SHAFT			The Contractor/ sub-contractor/vendor: i) Should have manufactured/executed *similar items/works* earlier during the last Twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations /Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units or at minimum one (1) Installation of at least four units. **or** iii) If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum one(1) Hydro Power Station/ Pump Storage Plant / Lift irrigation scheme of at least four units and the same shall be certified by ordering agency, in case of fabrication, forging & casting firms. iv) Should be an ISO certified company.
1.1.3	GUIDE VANE			
1.1.4	RUNNER			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project. Note: 1. 'Similar item/work' is defined as 50% and above size of likely dimension of components of prototype turbine as per below: i) Turbine Shaft: Outer dia.x Length ii) Guide vane: Width x Height iii) Runner:D3(Discharge Dia.) x H(Rated Head) 2. The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
1.1.5	SHAFT SEAL			The Sub-contractor/vendor: 1. Should have manufactured & supplied shaft seal of similar size during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. 2. The shaft seal so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units or at minimum one (1) Installation of at least four units. **Or** 3. If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum one(1) Hydro Power Station/ Pump Storage Plant / Lift irrigation scheme of at least four units and the same shall be certified by ordering agency. 4. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) / component(s) required for the project. Note: 1. 'Similar size' is defined as shaft seal of Francis turbine of a Hydro Power Plant/ Pump Storage Plants / Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity or above. 2. The certificate shall be issued by the OEM

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				complying with material compositions, grade and specifications as per TS.
1.1.6	HP-HVOF COATING			The Contractor / Sub-contractor/vendor: i) Should have executed coating works using JP-5000 HP-HVOF System or equivalent having coating thickness of 250 micron or higher, minimum hardness of 1100HV, smoothness of 6 Ra or better, Porosity of 1% or better, bond strength of 12000 PSI or higher and particle velocity of 700 m/sec or higher for hydro turbine during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The testing report carried out by NABL accredited lab shall be submitted for quality of material used for HVOF Coating. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to execute the work required for the project. Note: The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
1.1.7	SERVO MOTOR			The Sub-contractor/vendor: i) Should have designed, manufactured / executed turbine (Guide Vane) servomotor of at least 50% of required servomotor capacity (Stoke & Diameter) as per relevant IEEE and operating pressure range of 100-160 bar & above (considering two servomotors for turbine) during the last Twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The turbine (Guide Vane) servomotor manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units or at minimum one (1) Installation of at least four units. Or If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				one(1) Hydro Power Station/ Pump Storage Plant / Lift irrigation scheme of at least four units and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project. Note: The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
1.1.8	TURBINE DISCHARGE MEASURING EQUIPMENT (ULTRASONIC)			The Sub-contractor/vendor: i) Should have design, manufactured & supplied ultrasonic flow measurement equipment meeting requirement as per IEC 60041 during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations/ Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Or If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project.
1.1.9	SELF LUBRICATING BUSHES			The Sub-contractor/vendor: i) Should have manufactured & supplied similar item during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The Similar item so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations/ Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				units or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum one(1) Hydro Power Station/ Pump Storage Plant / Lift irrigation scheme of at least four units and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project. Note: 1. 'Similar item' is defined as relevant item or component of "hydro turbine generator set of minimum 50% of rated capacity" of hydro turbine generator set / Pump Storage / Lift irrigation scheme. 2. The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
2.0	**DIGITAL GOVERNING SYSTEM AND ACCESSORIES**			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
2.1	DIGITAL GOVERNORING SYSTEM			The Sub-contractor/vendor: i) Should have designed, manufactured, and supplied similar items during the last Twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment/system manufactured for similar item should have been successfully in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations/ Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units or at minimum one (1) Installation of at least four units. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project. Note: 'Similar item' is defined as digital governing system manufactured for 'minimum 50% of rating of unit capacity of hydro turbine generator set / Pump Storage' or 'Lift irrigation scheme having

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				pump of Francis type of at least 50% of rated capacity' with minimum operating pressure range of 100-160 bar.
2.2 2.3	PRESSURE ACCUMULATOR TANK GOVERNOR ACTUATOR FOR GUIDE VANE			The Sub-contractor/vendor: i) Should have designed, manufactured, and supplied similar items during the last Twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The items designed & manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations/ Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum one(1) Hydro Power Station/

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Pump Storage Plant / Lift irrigation scheme of at least four units and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project. Note: 1. 'Similar items' is defined as minimum 50% of the volume of unit capacity (having minimum operating pressure range of 100-160 bar) of hydro turbine generator set / Pump Storage / Lift irrigation scheme. 2. The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
2.4	HYDRAULIC OVERSPEED VALVE			The Sub-contractor/vendor: i) Should have designed, manufactured, and supplied similar items during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The items designed & manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations/ Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
2.5	SERVO / PROPORTIONAL VALVES			Note: i) 'Similar items' is defined as minimum 50% of the size (i.e. Flow rate) of relevant item/component (having minimum operating pressure range of 100-160 bar) for unit capacity of hydro turbine generator set / Pump Storage. ii) The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
2.6	OIL PUMPS			The Sub-contractor/vendor: i. Should have designed, manufactured and supplied oil pumps of at least 50% of required pumping capacity as per relevant IEEE having operating pressure range of 100-160 bar or above during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items designed & manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations/ Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. Or If the contractor (to whom LOA is placed by

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift Irrigation Scheme each comprising at least two units or at minimum one(1) Hydro Power Station/ Pump Storage Plant / Lift Irrigation Scheme of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) /component(s) required for the project.
3.0	**MAIN INLET VALVE AND ACCESSORIES**			
3.1	**MAIN INLET VALVE (Fabrication & Manufacturing of Main Inlet Valve)**			**AS PER PQ CRITERIA**
3.2	BY-PASS VALVE AND AIR RELEASE VALVE			The Sub-contractor/vendor: i. Should have manufactured / supplied similar items during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The equipment manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations, **each comprising** at least two units or at minimum one (1) Hydro Power Station of at least four units. **Or**

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project. If any of the items mentioned at Sl. No. 3.2 to 3.6 is/are manufactured by main contractor/JV partner does not require any specific approval and hence no document shall be required. Similarly, If a manufacturer (meeting the qualifying requirement as per bid condition) has been associated at bidding stage, the said manufacturer does not require any specific approval & hence no documentary evidence shall be required to furnish against relevant item(s). Note: 'Similar item' is defined as relevant item or component of hydro turbine generator set of minimum 50% of rated capacity and minimum 50% of rated head.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
3.3	SERVOMOTOR			The Sub-contractor/vendor: i. Should have designed & manufactured, supplied MIV double acting servomotor at least 50% of required servomotor capacity (Stoke & Diameter) as per relevant IEEE and operating pressure range of 100-160 bar and above (considering two servomotors for MIV) during the last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The MIV double acting servomotor designed, manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations, each comprising at least two units or at minimum one (1) Hydro Power Station of at least four units. **or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				technical capability and financial resources to design and manufacture or supply the item(s) / component(s) required for the project. Note: The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
3.4	PRESSURE ACCUMULATOR TANK			The Sub-contractor/vendor: i) Should have manufactured & supplied similar items earlier during last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Stations / Pump Storage / Lift Irrigation Scheme each comprising at least two units or at minimum one(1) Hydro Power Station / Pump Storage / Lift Irrigation Scheme of at least four units and the same shall be certified by ordering agency. iii) Should be an ISO certified company In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) / component(s) required for the project. Note: 'Similar items' is defined as minimum 50% of the volume of unit capacity (having minimum operating pressure range of 100-160 bar) of hydro turbine generator set / Pump Storage/Lift Irrigation Scheme.
3.5	OIL PUMPS			The Sub-contractor/vendor: i. Should have designed & manufactured/ supplied oil pumps of at least 50% of required pumping capacity having operating pressure range of 100-160 bar or above during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least four units in operation.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage / Lift Irrigation Scheme each comprising at least two units or at minimum one(1) Hydro Power Station / Pump Storage / Lift Irrigation Scheme of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design and manufacture or supply the item(s)/component(s) required for the project.
3.6	SELF LUBRICATING BUSHES			The Sub-contractor/vendor: i) Should have designed & manufactured /supplied similar item of MIV during the last twenty (20) years ending last day of the month previous to the one in which

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Contractor proposes / applies for inclusion. ii) The Similar item designed & manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least four units. **or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage each comprising at least two units or at minimum one(1) Hydro Power Station / Pump Storage of at least four units and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design and manufacture or supply the item(s)/component(s) required for the project. Note: 1. 'Similar item' is defined as relevant item or component of "hydro turbine generator set of minimum 50% of rated capacity" of hydro turbine generator set / Pump Storage. 2. The certificate shall be issued by the OEM complying with material

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				compositions, grade and specifications as per TS.
4.0	**GENERATOR**			
4.1	**Fabrication & Manufacturing of Major Parts**			
4.1.1	STATOR FRAME AND SOLE PLATES			The Sub-contractor/vendor: i. Should have manufactured/executed *similar items/works* earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The equipment manufactured by the subcontractor/sub-vendor for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity & 50% of rated head may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured
4.1.2	STATOR CORE (ELECTRICAL SHEET STEEL)			
4.1.3	STATOR BARS			
4.1.4	ROTOR SPIDER			
4.1.5	ROTOR RIM SHEETS (PUNCHING)			
4.1.6	GENERATOR SHAFT(S)			
4.1.7	UPPER AND LOWER BRACKET			
4.1.8	GUIDE/THRUST BEARING			
4.1.9	THRUST BEARING OIL COOLERS			
4.1.10	GUIDE BEARING OIL COOLERS			
4.1.11	STATOR AIR COOLERS			
4.1.12	HS LUBRICATION SYSTEM			
4.1.13	BRAKE DUST COLLECTOR			
4.1.14	CARBON DUST COLLECTOR			
4.1.15	BRAKE/JACK SYSTEM			
4.1.16	BEARING OIL (FOR TURBINE &			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
	GENERATOR)			for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift Irrigation Scheme, each comprising at least two units Or at minimum one (1) Hydro Power Station/ Pump Storage Plant / Lift Irrigation of at least four units and the same shall be certified by ordering agency in case of fabrication, forging & casting firms. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to manufacture the item(s)/component(s) required for the project. If any of the items mentioned at Sl. No. 4.1.1 to 4.1.16 is/are manufactured by main contractor/JV partner does not require any specific approval and hence no document shall be required. Similarly, If a manufacturer (meeting the qualifying requirement as per bid condition) has been associated at bidding stage, the said manufacturer does not require any specific approval & hence no documentary evidence shall be required to furnish against relevant item(s). Note: 1. 'Similar item/equipment' is defined as relevant item/component of hydro turbine generator set / Pump Storage / Lift Irrigation Scheme of minimum 50% of rated capacity and minimum 50% of rated head. 2. The certificate shall be issued by the OEM complying with material compositions, grade and

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				specifications as per TS.
4.2	**INSTRUMENTS AND DEVICES common for Turbine, Generator, MIV and Governor**			
4.2.1	VIBRATION MONITORING SYSTEM			The Sub-contractor/vendor: i. Should have designed, manufactured/ supplied and commissioned items/ equipment for hydro generating unit having capacity of minimum 50% of rated capacity earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items/equipment manufactured by the subcontractor/sub-vendor should have been in satisfactory operation for at least two years at minimum two (2) Power Stations, each comprising at least two units or at minimum one (1) Power Station of at least four units. Or If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Power Stations each comprising at least two units or at minimum one (1) Power Station of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial
4.2.2	AIR GAP MONITORING SYSTEM			
4.2.3	PARTIAL DISCHARGE MONITOR SYSTEM			
4.2.4	SHAFT CURRENT MONITORS			
4.2.5	FIRE PROTECTION EQUIPMENT			
4.2.6	ELECTRICAL BRAZING DEVICE / EQUIPMENT			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				resources to design and manufacture or supply the item(s)/component(s) required for the project. Note: The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
4.2.7	MERCURY / GAS IN STEEL THERMOMETERS (DTT)			The Sub-contractor/vendor: i. Should have manufactured, type test / performance test & supplied equipment/ items earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory
4.2.8	PRESSURE SWITCH			
4.2.9	FLOW RELAY, FLOW METER, FLOW SWITCH AND LEVEL SWITCH			
4.2.10	PRESSURE TRANSMITTERS			
4.2.11	THERMOSTATS			
4.2.12	RTD			
4.2.13	MOISTURE DETECTOR			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift Irrigation Scheme, each comprising at least two units Or at minimum one (1) Hydro Power Station/ Pump Storage Plant / Lift Irrigation of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) / component(s) required for the project.
5.0	**DIGITAL STATIC EXCITATION SYSTEM**			The Sub-contractor/vendor: i. Should have designed, manufactured and supplied similar static excitation system earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations, each comprising at least two units or at minimum one (1) Hydro Power Station of at least four units. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: 'Similar static excitation system' is defined as used in relevant item/component of hydro generator of minimum 50% of rated capacity and generating voltage minimum of 11kV.
5.1	DRY TYPE EXCITATION TRANSFORMER			The Sub-contractor/vendor: i. Should have designed, manufactured, type tested and supplied *similar equipment* earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The equipment manufactured .for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations, each comprising at least two units or at minimum one (1) Hydro Power Station of at least four units. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: Similar Item is defined as used in relevant item/ component of hydro generator of minimum 50% of rated capacity.
6.0	**GENERATOR CIRCUIT BREAKER**			The Sub-contractor/vendor:

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				i) Should have designed, manufactured, type tested, supplied, installed, tested & commissioned of minimum 50% of rated current capacity and minimum 50% of rated Voltage of 3-Phase Generator Circuit Breaker (GCB) in last Twenty (20) years, ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. The above GCB so manufactured should have been in satisfactory operation* for at least two years from the date of commissioning at minimum two(2) Power Stations, each comprising at least two units or at minimum one(1) Power Station of at least four units. **Satisfactory operation means certificate issued by the Employer/Owner/Purchaser certifying the satisfactory operation.* **OR** The manufacturers in India which are subsidiaries of any Indian/Foreign company can be qualified on the basis of experience of Parent/Holding company if the Parent/Holding Company meets the experience as stipulated above subject to Parent/Holding Company confirming full support for technical and financial requirements of the subsidiary company and commits to take up the work itself in case of non-performance by the subsidiary company. An additional performance guarantee for an amount of 3% of the cost of the system in the contract shall also be furnished. Note: • The type test report should be valid as per Central Electrical Authority's guidelines as on last day of the month previous to the one in which Contractor proposes / applies for addition / inclusion

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				ii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
7.0	**BUS DUCT**			The Sub-contractor/vendor: i. Should have designed, manufactured, type tested, supplied and commissioned 11 kV or above, bus duct having current rating of minimum 50% of rated bus duct current earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The equipment manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations, each comprising at least two units or at minimum one (1) Hydro Power Station of at least four units. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
7.1	CT's & PT's			The Sub-contractor/vendor: i. Should have designed, manufactured, type tested and supplied *similar Item* earlier during the last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The equipment manufactured by the subcontractor/sub-vendor for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations, each comprising at least two units or at minimum one (1) Hydro Power Station of at least four units. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: Similar equipment is defined as those used in relevant item/component of 11 KV or above, bus duct having current rating of minimum 50% of rated bus duct current.
7.2	NEUTRAL GROUNDING TRANSFORMER			
7.3	LIGHTENING / SURGE ARRESTOR			
7.4	INSULATORS/ BUSHINGS			
7.5	SURGE CAPACITOR			
8.0	**TRANSFORMERS**			
8.1	GSU TRANSFORMERS			The Sub-contractor/vendor: i) Should have designed, manufactured, type tested, supplied, installed, tested & commissioned of rated voltage class & above and minimum 50% of rated capacity, Transformers in last twenty (20) years, ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. The above transformers so

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				manufactured should have been in satisfactory operation* for at least two years from the date of commissioning at minimum two (2) Power Stations, each comprising at least two generating units or at minimum one (1) Power Station of at least four generating units. **Satisfactory operation means certificate issued by the Employer/Owner/Purchaser certifying the satisfactory operation.* **OR** The manufacturers in India which are subsidiaries of any Indian/Foreign company can be qualified on the basis of experience of Parent/Holding company if the Parent/Holding Company meets the experience as stipulated above subject to Parent/Holding Company confirming full support for technical and financial requirements of the subsidiary company and commits to take up the work itself in case of non-performance by the subsidiary company. An additional performance guarantee for an amount of 3% of the cost of the system in the contract shall also be furnished. Note: • The type test report should be valid as per Central Electrical Authority's guidelines as on last day of the month previous to the one in which Contractor proposes / applies for addition / inclusion iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				resources to manufacture the item(s)/component(s) required for the project.
8.2	OIL PUMPS			The Sub-contractor/vendor: i. Should have designed, manufactured, and supplied similar items during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items designed & manufactured should have been in satisfactory operation for at least two years at minimum two power stations/sub-stations. iii. Should be an ISO certified company In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: 'Similar item' is defined as transformer having capacity of minimum 50% of rated GSU transformer capacity of rated KV class or above.
8.3	DOUBLE WALLED OIL COOLERS			
8.4	HV BUSHING			
8.5	TRANSFORMER OIL			
8.6	MOISTURE DETECTOR (WATER IN OIL DETECTOR)			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
8.7	TRANSFORMER OIL DGA TEST SET			The Sub-contractor/vendor: i. Should have designed, manufactured, supplied & commissioned similar items during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items should have been in satisfactory operation for at least two years at minimum two power stations/sub-stations. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
9.0	**REACTOR**			
9.1	REACTOR			The Sub-contractor/vendor: i) Should have designed, manufactured, type tested, supplied, installed, tested & commissioned of minimum 50% of rated capacity of 400 KV class or **above 1-phase Reactor (if 1-phase reactor is in the scope of work other wise 3-Phase Reactor as per scope of work)** in last twenty (20) years, ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. The above Reactor so manufactured should have been in satisfactory operation* at least at two power stations/sub-stations for a period of minimum two (02) years from the date of commissioning.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Satisfactory operation means certificate issued by the Employer/Owner/Purchaser certifying the satisfactory operation.* **OR The manufacturers in India which are subsidiaries of any Indian/Foreign company can be qualified on the basis of experience of Parent/Holding company if the Parent/Holding Company meets the experience as stipulated above subject to Parent/Holding Company confirming full support for technical and financial requirements of the subsidiary company and commits to take up the work itself in case of non-performance by the subsidiary company. An additional performance guarantee for an amount of 3% of the cost of the system in the contract shall also be furnished. Note: The type test report should be valid as per Central Electrical Authority's guidelines as on last day of the month previous to the one in which Contractor proposes / applies for addition / inclusion. ii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) / component(s) required for the project.
9.2	OIL PUMPS			The Sub-contractor/vendor: i. Should have designed, manufactured, and supplied similar items during the last twenty (20) years ending last day of the month

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
9.3	DOUBLE WALLED OIL COOLERS			previous to the one in which Contractor proposes / applies for inclusion. ii. The items designed & manufactured should have been in satisfactory operation for at least two years at minimum two power stations/sub-stations. iii. Should be an ISO certified company In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: 'Similar item' is defined as transformer having capacity of minimum 50% of rated GSU transformer capacity of rated KV class or above.
9.4	HV BUSHING			
9.5	TRANSFORMER OIL			
9.6	MOISTURE DETECTOR (WATER IN OIL DETECTOR)			
10.0	**GAS INSULATED SWITCHGEAR**			
10.1	GAS INSULATED SWITCHGEAR			The Sub-contractor/vendor: i) Should have successful experience in designing, manufacturing, type test, supply, installation, testing & commissioning of at least two (2) nos. bays* of GIS having rated voltage or higher with current rating of minimum 50% of rated GIS bus bar current and Short circuit current rating of 50 kA or above during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for addition / inclusion. ii) The GIS so designed & manufactured should have been in satisfactory operation for at least two years at minimum two power stations/sub-stations.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				OR The manufacturer in India which has either supplied at least One (1) no. 380kV or higher with current rating of minimum 50% of rated GIS bus bar current and short circuit current rating of 50kA or above GIS bay* or type tested the same and which is subsidiary/group company or having collaboration with any Indian / Foreign company can be qualified on the basis of experience of Parent/Holding/Collaborating company if the Parent/Holding/ Collaborating company meets the experience as stipulated above and confirms full support for technical and financial requirements and commits to take up the work itself in case of non-performance by the subject manufacturer in India. An additional performance guarantee for an amount of 3% of the cost of the GIS package in the contract shall also be furnished by the Parent/Holding/Collaborating company. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: • (#)Satisfactory operation means certificate issued by the Employer certifying the operation without any adverse remark. • (*) One no. GIS Bay shall be considered as a bay used for controlling a line or a generator / transformer or a reactor and comprising of at least one circuit breaker, one Disconnector,

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				CTs, earthing switch and Surge Arrester.
11.0	**OUTDOOR POTYARD EQUIPMENT**			
11.1	CAPACITIVE VOLTAGE TRANSFORMER			the Sub-contractor/vendor shall have to meet the following criteria: I. Should have designed, manufactured, type tested (not for substation structure) and supplied equipment for rated voltage or higher voltage level earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. II. The equipment supplied should have been in satisfactory operation for at least two years at minimum two power stations/substations of rated voltage class or above. III. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
11.2	STRUCTURE, INSULATORS AND CLAMP CONNECTOR HARDWARE			
11.3	LINE/WAVE TRAP			
11.4	L. A./ SURGE ARRESTER			
11.5	CONDUCTOR			
12.0	**DC SYSTEMS (220V AND 48V, UPS & INVERTER)**			The Sub-contractor/vendor/integrator: i) Should have designed, supplied and commissioned DC System of similar size* of battery capacity and associated battery chargers & DCDB earlier during the last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so supplied by the subcontractor/sub-vendor for similar item should have been in satisfactory operation for at least two years at minimum two power

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				stations/sub-stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply & commission the item(s)/ component(s) required for the project. Note: Similar size* is defined as (i) Plante type battery bank of min.50% of rated capacity OR Ni-Cd (FNC) type /Pocket plate high discharge type (KOH) battery bank of min.50% of rated capacity (ii) 50% or above of design capacity of relevant equipment i.e. Battery charger (float cum boost charging), DCDB and Inverter.
12.1	BATTERY BANK			The Sub-contractor/vendor: i) Should have designed, manufactured, supplied and type tested **similar size*** of equipments during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so supplied by the subcontractor/sub-vendor should have been in satisfactory operation for at least two years at minimum two power stations/sub stations of **110 kV class** or above. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete
12.2	BATTERY CHARGERS			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: A. Similar size* is defined for Battery Bank as under: *Plante type battery bank of min. 50% of rated capacity* *OR* Ni-Cd (FNC) type battery bank of min. 50% of rated capacity / Pocket plate high discharge type (KOH) battery bank of min.50% of rated capacity B. Similar size* is defined for Battery Charger as under: *50% or above of design capacity of relevant equipment i.e. Battery charger (float cum boost charging), DCDB, UPS and Inverter.*
13.0	**CONTROL AND MONITORING SYSTEM**			
13.1	CONTROL AND MONITORING SYSTEM			The Sub-contractor/vendor: i) Should have successful experience in designing, manufacturing, supply, installation, testing & commissioning of Control, Protection and Monitoring Systems comprising integrated Computerized Control System for minimum **three units** or more in a power plant having capacity above 25MW in last twenty (20) years, ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The system so supplied by the subcontractor/sub-vendor should have been

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				in satisfactory operation for at least two years at minimum two power stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
13.2	PANELS/CUBICLES/ CONTROL BOARDS			The Sub-contractor/vendor: i) Should have manufactured, supplied and type tested similar items/equipment earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so supplied by the subcontractor/sub-vendor should have been in satisfactory operation for at least two years at minimum two power stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
13.3	LED DISPLAY			
13.4	HMI, PLC's, OPERATOR WORKSTATIONS			
13.5	SERVERS/ NETWORK COMPONENTS			
13.6	PCs/LAPTOPS & OTHER ACCESSORIES			
14.0	**PROTECTION SYSTEM**			
14.1	PROTECTION SYSTEM			The Sub-contractor/vendor: i) Should have successful experience in designing, manufacturing, supply, installation, testing & commissioning of Protection Systems comprising Numerical

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Protection System for minimum three units or more in a power plant having capacity above 25MW in last twenty (20) years, ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The system so supplied by the subcontractor/sub-vendor should have been in satisfactory operation for at least two years at minimum two power stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
14.2	PANELS/CUBICLES			The Sub-contractor/vendor: i) Should have manufactured, supplied and type tested similar items/equipment earlier during the last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The items/equipment so supplied by the subcontractor/sub-vendor for similar item should have been in satisfactory operation for at least two years at minimum two power stations/Substation. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient
14.3	MAIN PROTECTION RELAYS			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: Similar items/equipment is defined as used in relevant item/equipment of protection systems comprising numerical protection system in a power plant having capacity of 25 MW or above / Substation (110 kV & above).
14.4	STATIC / ELECTRO-MECHANICAL PROTECTION / AUXILIARY / TRIPPNG RELAYS			The Sub-contractor/vendor: i) Should have manufactured, type tested, supplied similar items* earlier during last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The items so supplied by the subcontractor/sub-vendor for similar items should have been in satisfactory operation for at least two years at minimum two power stations/Substation. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note*: Similar items/equipment is defined as used in relevant item/equipment of protection systems comprising numerical protection system in a power plant having capacity of 25 MW or above / Substation (110 kV & above).
14.5	AUX. CT & PT			
15.0	**CABLING SYSTEM**			The Sub-contractor/vendor: i) Should have designed, supplied and commissioned at least 1000 KM of cabling system consisting of control, LT and 11KV

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				power cables in power station/ switchyard of 110 kV class or above earlier during last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The system so supplied by the subcontractor/sub-vendor should have been in satisfactory operation for at least two years at minimum two power stations/sub-stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply and commission the item(s)/component(s) required for the project.
15.1	11kV XLPE CABLES			The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied 100kms or above (all sizes inclusive) of 11KV XLPE cables earlier during last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment manufactured should have been in satisfactory operation for at least two years at minimum two power stations/sub-stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				resources to manufacture the item(s)/component(s) required for the project.
15.2	LT POWER CABLES			The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied 500 kms or above with at least one single order of 50 km or above (all sizes inclusive) of LT power cables earlier during last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The item so manufactured should have been in satisfactory operation for at least two years at minimum two power stations/sub-stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
15.3	CONTROL CABLES AND INSTRUMENTATION CABLES			The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied 500kms or above with at least one single order of 50 km or above (all sizes inclusive) of control and instrumentation cables earlier during last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The item so manufactured should have been in satisfactory operation for at least two years at minimum two power stations/sub-stations.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
15.4	CABLE TRAYS, RACKS INCLUDING ACCESSORIES			The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied 100kms or above Cable trays with at least one single order of 5km or above earlier during the last twenty(20)years, ending last day of the month previous to the one in which Contractor proposes / applies for addition / inclusion, at minimum two power stations. ii) The item so manufactured should have been in satisfactory operation for at least two years at minimum two power stations/sub-stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
16.0	**MV SWITCHGEAR**			The Sub-contractor/vendor/**Integrator:** i) Should have designed, Type tested, supplied and commissioned switchgear system having minimum 11kV voltage with short circuit rating of 25 kA or above and having current rating of minimum 50% of rated bus

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				bar current earlier during the last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so supplied should be satisfactory in operation for at least two years at minimum two Power stations/ sub-stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply and commission the item(s)/component(s) required for the project.
16.1	11 KV CB			The Sub-contractor/vendor: i) Should have designed, manufactured, type tested and supplied 11KV CB with short circuit rating of 25kA or above and having minimum 50% of rated current earlier during the last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been successfully commissioned/ in operation for at least two years at minimum two (2) Power stations/ sub-stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				component(s) required for the project.
16.2	CT & PT			The Sub-contractor/vendor: i) Should have manufactured, type tested, supplied items earlier during last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The items so manufactured should have been in successful operation for at least two years at minimum three Power station/ Substation. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
17.0	**DG SETS**			
17.1	**DG SETS – SYSTEM INTEGRATOR**			The Sub-contractor/vendor/integrator: i) Should have designed, supplied and commissioned DG sets having rated voltage and minimum of 50% of rated capacity earlier during the last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The DG set so supplied should have been in satisfactory operation at least at two years at minimum two (2) industrial installations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply and commission the item(s)/component(s) required for the project.
17.2	ENGINE			The Sub-contractor/vendor: i) Should have manufactured, performance/type tested and supplied relevant equipment compatible to minimum 50% of rated output of alternator earlier during last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in satisfactory operation at least at two years at minimum two industrial installations. iv) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
17.3	ALTERNATOR			
18.0	**415V SWITCHGEAR AND AUXILIARY TRANSFORMERS**			
18.1	415V SWITCHGEAR PANEL/UAB/ SSB			The Sub-contractor/vendor: i) Should have designed, supplied, type tested and commissioned 415V LT switch gear system with short circuit rating of 50kA or above and having current rating of minimum 50% of rated bus bar current earlier during last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				ii) The equipment so supplied should have been in satisfactory operation for at least two years at minimum two power stations/ substations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply & commission the item(s)/component(s) required for the project.
18.2	LV BUS DUCT			The Sub-contractor/vendor: i) Should have manufactured, type tested, supplied and commissioned relevant items / equipment earlier during last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in satisfactory operation for at least two years at minimum two (2) power stations/ substations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to supply the item(s)/component(s) required for the project.
18.3	CT/PT			The Sub-contractor/vendor: i) Should have manufactured, type tested, supplied items earlier during last twenty (20)years ending last day of the month

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
18.4	NUMERICAL/PROTECTION / AUXILIARY RELAYS			previous to the one in which Contractor proposes / applies for inclusion. ii) The items so manufactured should have been in satisfactory operation at least two years at minimum two Power stations/ Sub-stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturer capability and financial resources to manufacture the item(s)/component(s) required for the project.
18.5	OIL TYPE TRANSFORMER			The Sub-contractor/vendor: i) Should have designed, manufactured, type tested 'Similar transformer*' at 11 KV class or above earlier during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The transformer so manufactured should have been in satisfactory operation at least two years at minimum two (2) power stations/ sub-stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
18.6	DRY TYPE TRANSFORMER			item(s)/component(s) required for the project. Note: Similar Transformer* is defined as below for relevant transformers: (i) For Dry Type Transformer: 11KV/415V Dry type Transformer having capacity of min. 500KVA. (ii) For Oil Type Transformer: 11KV/415V Oil type Transformer having capacity of min. 500 KVA.
19.0	**ILLUMINATION SYSTEM**			
19.1	ILLUMINATION SYSTEM INTEGRATOR			The Sub-contractor/vendor: i) Should have designed, supplied and commissioned illumination system for power station having capacity of 25MW or above earlier during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				ii) The system so supplied should have been in satisfactory operation at least two years at minimum at two (2) power stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply & commission the item(s)/component(s) required for the project.
19.2	LUMINAIRES / FITTINGS MODULAR SWITCHES / SOCKETS UPS / INVERTER			The Sub-contractor/vendor: i) Should have manufactured, type tested, supplied items earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The items so manufactured should have been in satisfactory operation at least two years at minimum two (2) industrial installations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
20.0	**COMMUNICATION SYSTEM**			
20.1	PUBLIC ADDRESS SYSTEM INTEGRATOR			The Sub-contractor/vendor/Integrator: i) Should have designed, supplied and commissioned Public address system for hydro power station having capacity of 25

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				MW or above during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so supplied should have in satisfactory operation for at least two years at minimum two power stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply and commission the item(s)/component(s) required for the project.
20.2	PUBLIC ADDRESS SYSTEM			The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied Public address system for hydro power station having capacity of 25 MW or above during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have in satisfactory operation for at least two years at minimum two power stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
20.3	EPABX			The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied *similar items/ equipment earlier during last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in successful for at least two years at minimum two power stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: '*Similar items/equipment' is defined as used in relevant item/equipment of communication systems in a Power plant having capacity of 25 MW or above.
20.4	CONFERENCING SYSTEM			
21.0	**ELECTRICAL WORKSHOP**			
	MOISTURE MEASUREMENT KIT			The Sub-contractor/vendor: i) Should have manufactured, supplied and commissioned relevant *similar items / equipments earlier during the last twenty (20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The items/equipment should have been in satisfactory operation for at least two years at minimum two (2) Power stations. iii) Should be an ISO certified company.
	RESISTIVITY MEASUREMENT KIT			
	TRANSFORMER OIL DIELECTRIC TESTER			
	AC/DC INSULATION TESTERS			
	AC/DC MULTIMETERS			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
	AC HV TEST KIT			In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: '*Similar items/equipment' is defined as used in relevant item/equipment of Electrical workshop of Power stations.
	PRIMARY CURRENT INJECTION SET			
	UNIVERSAL RELAY TESTING KIT			
	TRANSFORMER WINDING RESISTANCE MEASUREMENT KIT			
	TURNS RATIO TESTER			
	DC RECTIFORMER RECTIFIRE ASSEMBLY			
	AUTOMATIC CAPACITANCE AND TAN DELTA KIT			
	SILT MEASURING EQUIPMENT			
	TOROIDAL TRANSFORMERS			
	PORATABLE MULTI CHANNEL VIBRATION METER			
	PORTABLE EARTH RESISTANCE MEASUREMENT DEVICE			
	STROBOSCOPE			
	CRO			
	MICRO OHM METER			
	DC EARTH FAULT LOCATOR			
	DEW POINT METER			
	CIRCUIT BREAKER TIMING			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
	MEASUREMENT ANALYSER			
22.0	**ELECTRIC OVERHEAD TRAVELLING (EOT) CRANES**			
22.1	EOT CRANE			The Sub-contractor/vendor: i) Should have designed, manufactured and supplied similar EOT crane during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The EOT crane should have been in satisfactory operation for at least two years at minimum two Power Stations / industrial installations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: '*Similar EOT Crane' is defined as EOT crane having capacity of 50% & span of 75% of required crane capacity or higher.
	VVVF DRIVE			
	WIRE ROPES			
22.2	MOTORS			The Sub-contractor/vendor: i) Should have designed, manufactured, type tested and supplied *similar items/ equipment earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in satisfactory operation for at least two years at minimum two power stations / industrial installation.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: '*Similar items/equipment' is defined as used in relevant item/equipment of required EOT crane having capacity of 50% & span of 75% of required crane capacity or higher.
23.0	**COOLING WATER SYSTEM INTEGRATOR**			The Sub-contractor/vendor: i) Should have designed, supplied and commissioned cooling water system for underground power station having capacity of 25MW or above earlier during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The system so supplied should have been in successful operation for at least two years at minimum two hydro power stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply and commission the item(s)/component(s) required for the project.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
23.1	PUMPS			The Sub-contractor/vendor: i) Should have manufactured, type tested / performance tested and supplied horizontal centrifugal pump having 50% or above of design capacity earlier during last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The pump so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. **Or** Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
23.2	AUTOMATIC BACKWASH DUPLEX STRAINER			The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied automatic backwash duplex

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				wedge wire type strainer having 50% or above of design capacity with filtration size (up to 600 micron for primary and up to 100 micron for secondary system) earlier during last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The pump so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum one(1) Hydro Power Station/ Pump Storage Plant / Lift irrigation scheme of at least four units and the same shall be certified by ordering agency.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
23.3	FLOW RELAY/ FLOW METER / FLOW SWITCH/ LEVEL SWITCH			The Sub-contractor/vendor: i. Should have manufactured, type test / performance test & supplied equipment/ items earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Or If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift Irrigation Scheme, each comprising at least two units Or at minimum one (1) Hydro Power Station/ Pump Storage Plant / Lift Irrigation of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) / component(s) required for the project.
23.4	CYCLONE SEPERATORS			The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied cyclone separator: For Primary cooling water circuit: Single stage, 75 micron having 50% or better of design capacity, earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The item so manufactured should have been in satisfactory operation for at least two years at minimum two hydro power stations/ Pump Storage, each comprising at least two

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum one(1) Hydro Power Station/ Pump Storage Plant / Lift irrigation scheme of at least four units and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note The certificate shall be issued by the OEM complying with material compositions, grade and

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				specifications as per TS.
23.5	AUTOMATIC SELF-CLEANING SIMPLEX / DUPLEX FILTER (SHAFT SEAL)			The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied automatic self-cleaning simplex / duplex wedge wire type filter having 50% or above of design capacity with filtration size of 50 micron or better earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The item so manufactured should have been in satisfactory operation for at least two years at minimum two hydro power stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum one(1) Hydro Power Station/ Pump Storage Plant / Lift irrigation scheme of at least four

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				units and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
23.6	HEAT EXCHANGERS			The Sub-contractor/vendor: i) Should have manufactured, type tested / performance tested and supplied heat exchangers earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The item so manufactured should have been in satisfactory operation for at least two years at minimum two hydro power stations / Thermal / Oil / Gas/industrial applications. Similar item is defined as wide plate type heat exchanger of similar specifications with 50 % of rated flow capacity. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) /

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				component(s) required for the project.
24.0	**DRAINAGE AND DEWATERING SYSTEM INTEGRATOR**			The Sub-contractor/vendor/Integrator: i) Should have designed, supplied and commissioned drainage and dewatering system for underground power station having capacity of 25MW or above during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The system so supplied should have been in satisfactory operation for at least two years at minimum two hydro power stations / Pump Storage. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply & commission the item(s)/component(s) required for the project.
24.1	SUBMERSIBLE PUMPS			The Sub-contractor/vendor: i) Should have manufactured, type tested / performance tested and supplied submersible pump having capacity of 50% or above of pump's design discharge at 50% of design head or above, earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in successful operation for at least two years at minimum two hydro power stations / Pump Storage. **Or**

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
24.2	FLOW RELAY/ FLOW METER / FLOW SWITCH/ LEVEL SWITCH			The Sub-contractor/vendor: i. Should have manufactured, type test / performance test & supplied equipment/ items earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift Irrigation Scheme, each comprising at least two units Or at minimum one (1) Hydro Power Station/ Pump Storage Plant / Lift Irrigation of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) / component(s) required for the project.
25.0	**HEATING, VENTILATION AND AIR CONDITIONING (HVAC) SYSTEM**			
25.1	HVAC SYSTEM INTEGRATOR			The Sub-contractor/vendor/Integrator: i) Should have designed, supplied and commissioned HVAC system for underground power station having capacity of 25MW or above earlier during the last twenty(20)years ending last day of the month previous to the one in which Contractor

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				proposes / applies for inclusion. ii) The system so supplied should have been in satisfactory operation for at least two years at minimum two hydro power stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply & commission the item(s)/component(s) required for the project.
25.2	AHU			The Sub-contractor/vendor: i) Should have manufactured and supplied items / equipment earlier during last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
	PACKAGED AC (WATER COOLED/AIR COOLED)			
	PUMPS			
	AUTOMATIC SELF-CLEANING FILTER			
	CYCLONE SEPARATOR			
	FANS/BLOWERS			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
25.3	FLOW RELAY/ FLOW METER / FLOW SWITCH			The Sub-contractor/vendor: i. Should have manufactured, type test / performance test & supplied equipment/ items earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works*

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift Irrigation Scheme, each comprising at least two units Or at minimum one (1) Hydro Power Station/ Pump Storage Plant / Lift Irrigation of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) / component(s) required for the project.
26.0	**COMPRESSED AIR SYSTEMS**			
26.1	COMPRESSOR			The Sub-contractor/vendor: i) Should have manufactured, type tested / performance test and supplied LP compressor of 7 bar or above earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project.
26.2	BLOW DOWN AIR COMPRESSOR			The Sub-contractor/vendor: i) Should have designed, manufactured, type tested / performance tested and supplied compressor suitable for synchronous condenser air working pressure or above earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Power stations / industrial installations. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations and the same shall be certified by ordering agency.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
26.3	AIR DRYER			The Sub-contractor/vendor: i) Should have designed, manufactured, type / performance tested and supplied items/equipment earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in successful operation for at least two years at minimum two (2) power stations / industrial installations. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				resources to manufacture the item(s)/component(s) required for the project.
27.0	**FIRE FIGHTING SYSTEM**			
27.1	FIRE FIGHTING SYSTEM INTEGRATOR			The Sub-contractor/vendor/Integrator: i) Should have designed, supplied and commissioned fire fighting system of Transformer, Cables & other equipment consisting of high velocity water, medium velocity water, water sprinkler and fire hydrant system earlier during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The system so supplied should have been in satisfactory operation for at least two years at minimum two (2) power stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply and commission the system required for the project.
27.2	PUMP/MOTOR SET			These are important equipment for safety of plant and personnel. Contractor/vendor has to meet the following criteria and UL Listed & NFPA/TAC recommended equipment shall only be accepted. The Sub-contractor/vendor: i) Should have manufactured, type/ performance tested and supplied of items/equipment earlier during last twenty(20)years ending last day of the month previous to the one in which
	FIRE ALARM PANEL			
	DELUGE VALVE			
	HEAT/SMOKE DETECTORS & OTHER DETECTORS			
	OPTICAL/BEAM DETECTORS			
	LHS CABLE			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
	ASPIRATOR TYPE SMOKE DETECTION SYSTEM			Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/ component(s) required for the project.
	PORTABLE FIRE EXTINGUISHERS			
27.3	FLOW RELAY/ FLOW METER / FLOW SWITCH/ LEVEL SWITCH			The Sub-contractor/vendor: i. Should have manufactured, type test / performance test & supplied equipment/ items earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift Irrigation Scheme, each comprising at least two units Or at minimum one (1) Hydro Power Station/ Pump Storage Plant / Lift Irrigation of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) / component(s) required for the project.
28.0	**OIL HANDLING SYSTEM**			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
28.1	LUBRICATING OIL FILTRATION PLANT			The Sub-contractor/vendor: i) Should have designed, manufactured, type / performance tested and supplied equipment/plant capacity of minimum 50% of insulating oil filtration plant or minimum 50% of lubricating oil filtration plant earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The oil filtration plants/ equipment so manufactured should have been in satisfactory operation for at least two years at minimum two power stations/ industrial installations. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
	INSULATING OIL FILTRATION PLANT			
28.2	PUMPS			The Sub-contractor/vendor: i) Should have designed, manufactured, type / performance tested and supplied of items/equipment earlier during last
	VACUUM PUMPS			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
	CENTRIFUGE			twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
29.0	**MECHANICAL WORKSHOP**			
29.1	LATHE MACHINE			The Sub-contractor/vendor: i. Should have manufactured, supplied and items/equipment earlier during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items/equipment should have been in successful operation for at least two years at minimum two (2) power stations/industrial
	BATTERY OPERATED FORK LIFTER			
	BATTERY OPERATED HANDLING CARTS			
	WELDING MACHINES/ GENERATORS			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
	RADIAL DRILLING MACHINE			installations. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: 'Similar items/equipment' is defined as used in relevant item/equipment of Mechanical workshop of Power stations/Industrial installations.
	STATIONARY DRILLING MACHINE			
	PIPE BENDING MACHINE			
	HYDRAULIC TORQUE TENSIONER			
	PRECISION INSTRUMENTS • VERNIER CALLIPER • DIAL GAUGE • HEIGHT GAUGE • STRAIGHT EDGE • SCREW GAUGE • MASTER LEVEL • OPTICAL LEVEL • DEPTH GAUGE • INSIDE AND OUTSIDE MICRO METER • SURFACE PLATE			
	GRINDING MACHINE			
	HYDRAULIC PLATFORM			
	ELECTRICAL HAND DRILLLING MCHINE			
	POTABLE MAGNETIC BASE ELECTRICAL DRILLING MACHINE			
	POWER HACKSAW			
30.0	**ELEVATOR**			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
30.1	ELEVATOR			The Sub-contractor/vendor: i) Should have designed, manufactured, type / performance tested, supplied and commissioned Elevator having capacity minimum 10 persons earlier during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The elevator should have been in satisfactory operation for at least two years at minimum two power stations/industrial installations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project.
30.2	WIRE ROPE			
31.0	**SECURITY AND SERVEILLANCE SYSTEM**			
31.1	SECURITY AND SERVEILLANCE SYSTEM INTEGRATOR			The Sub-contractor/vendor: i) Should have designed, supplied and commissioned security & surveillance system for three power stations/ installations during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				inclusion. ii) The system so supplied should have been in satisfactory operation for at least two years at minimum two power stations/ Industrial installations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply & commission the item(s)/component(s) required for the project.
31.2	ACCCES CONTROL SYSTEM AND CCTV SURVELLIANCE SYSTEM			The Sub-contractor/vendor: i) Should have manufactured, type tested, supplied *similar equipment earlier during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment should have been in satisfactory operation at least at two (2) power stations/ Industrial installations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturer capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: '*Similar equipment' is defined as used in relevant item/equipment of security & surveillance system for Power stations/Industrial installations.

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
32.0	**MISCELLANEOUS ITEMS**			
32.1	AUTOMATIC SELF-CLEANING SIMPLEX / DUPLEX FILTER			The Sub-contractor/vendor: i) Should have manufactured, type tested / performance tested and supplied automatic self-cleaning simplex / duplex wedge wire type filter having 50% or above of design capacity with filtration size of 600 micron or better earlier during last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The item so manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum one(1) Hydro Power Station/ Pump Storage

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				Plant / Lift irrigation scheme of at least four units and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
32.2	CYCLONE SEPERATORS			The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied cyclone separator: Single stage, 75 micron having 50% or better of design capacity, earlier during last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The item so manufactured should have been in satisfactory operation for at least two years at minimum two hydro power stations/ Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station/ Pump Storage Plant of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage Plants / Lift irrigation scheme, each comprising at least two units or at minimum one(1) Hydro Power Station/ Pump Storage Plant / Lift irrigation scheme of at least four units and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s)/component(s) required for the project. Note The certificate shall be issued by the OEM complying with material compositions, grade and specifications as per TS.
32.3	MOTORS			The Sub-contractor/vendor: i) Should have manufactured, supplied and commissioned relevant *similar items/equipment earlier during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion.
	CT & PT			
	NUMERICAL RELAY			
	STATIC / ELECTRO-MECHANICAL PROTECTION / AUXILIARY /			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
	TRIIPNG RELAYS			ii) The items/equipment should have been in satisfactory operation for at least two years at minimum two (2) power station/ Industrial installations. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum two (2) Power Stations / industrial installations and the same shall be certified by ordering agency. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturer capability and financial resources to manufacture the item(s)/component(s) required for the project. Note: '*Similar items/equipment' is defined as miscellaneous items/equipment used in Power stations/Industrial installations.
	RTDS			
	CIRCUIT BREAKERS/ MCBs/ MCCBs			
32.4	PANELS/ CUBICLES/ CONTROL BOARDS			
	TERMINAL BLOCKS & ACCESSORIES, SIDE CLAMPS			
	STARTERS & CONTACTORS			
	TRIP CIRCUIT SUPERVISION RELAY			
	MOTOR PROTECTION CKT BREAKERS			
	VALVES – AIR TYPE			
	VALVES – OIL TYPE			
	VALVES – WATER TYPE			
	HEAD RACE AND TAIL RACE LEVEL SENSORS AND INDICATORS			
	PRESSURE GAUGE			
	PRESSURE SWITCH/ PRESSURE TRANSMITTER			
	LEVEL SWICTH/ INDICATOR/RADAR TYPE LEVEL SENSOR			

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
	HORIZONTAL CENTRIFUGAL PUMPS			
	TEMPERATURE SENSING DEVICES/DTT			
	THERMOSTATS			
32.5	FLOW RELAY/ FLOW METER / FLOW SWITCH/ LEVEL SWITCH			The Sub-contractor/vendor: i. Should have manufactured, type test / performance test & supplied equipment/ items earlier during the last twenty (20) years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii. The items manufactured should have been in satisfactory operation for at least two years at minimum two (2) Hydro Power Stations / Pump Storage, each comprising at least two units or at minimum one (1) Hydro Power Station / Pump Storage of at least four units. Lift irrigation scheme having pump of Francis type with at least 50% of Unit capacity may be considered by the Employer based on merit of each case. The equipment manufactured for similar item should have been in satisfactory operation for minimum two years at above two (2) installations, each comprising at least two units Or at minimum one (1) Installation of at least four units. **Or** If the contractor (to whom LOA is placed by NHPC) is not the manufacturer, they should have successfully executed *similar works* i.e. the equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				two (2) Hydro Power Stations / Pump Storage Plants / Lift Irrigation Scheme, each comprising at least two units Or at minimum one (1) Hydro Power Station/ Pump Storage Plant / Lift Irrigation of at least four units and the same shall be certified by ordering agency. iii. Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical & manufacturing capability and financial resources to manufacture the item(s) / component(s) required for the project.
33.0	**LIST OF AGENCIES:**			
33.1	ERECTION / INSTALLATION SERVICES			The Sub-contractor/vendor: i) Should have erected / installed at least two hydro power plants having minimum three numbers vertical turbine generator units of capacity 25MW or above earlier during the last twenty(20)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The equipment so erected should have been in satisfactory operation at least at two (2) Hydro Power stations, for minimum two (02) years. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to

Sl. No.	Items of Facilities	Name of Sub-Contractors / Vendors	Country of origin of Goods	Specific Qualification Criteria
				execute the work required for the project.

Note:

1. **Vendor/Sub-Contractor need to invariably comply with detailed technical specification covered in GTR, GTS and PTS.**

2. **Proposed Subcontractor/ vendor by the contractor shall adhere to 'Make in India policy' as defined in Public procurement (Preference to Make in India), Order 2017 or amendment thereof issued by Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce & Industry, G.O.I.**

3. **Vendor/Sub-Contractor proposed by the Contractor shall comply with the provision of "Restrictions under Rule 144 (xi) of the General financial Rule (GFRs) 2017" dated 23.07.2020 and subsequent amendment/clarifications issued by DPIIT, Ministry of Commerce & Industry, G.O.I.**

4. **Hydro Power stations cover conventional hydro power stations as well as Pump Storage Plants.**

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URI I STAGE II HYDROELECTRIC PROJECT

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URI I STAGE II HYDROELECTRIC PROJECT Volume III C (TDS)

1 GENERAL TECHNICAL REQUIREMENTS

1.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
A.	**Bid Evaluation Performance Parameters**			
1	**Turbine**			
1.1	Turbine rated output at rated net head of 227 m within 85% guide vane opening and at rated speed of 333.33 rpm	MW	Minimum 121.827 MW	Confirmed
1.2	Turbine maximum output at rated net head of 227 m with full guide vane opening and at rated speed of 333.33 rpm	MW	Minimum 134 MW	Confirmed
1.3 (a)	Turbine weighted average efficiency with coated Runner in line with PTS clause no. 2.4.2. upto "1" decimal place	%	Minimum 94.0	Confirmed
1.3 (b)	Turbine weighted average efficiency with un coated Runner in line with PTS clause no. 2.4.2. upto "1" decimal place	%	Minimum 94.3	Confirmed
2	**Generator**			
2.1	Generator rated power at rated power factor of 0.85 and at any voltage and frequency in the specified operating range without exceeding the maximum permissible temperature limits	MVA	Minimum 141.2 MVA	Confirmed
2.2	Generator maximum power at rated power factor of 0.85 and at any voltage and frequency in the specified operating range without exceeding the maximum permissible temperature limits	MVA	Minimum 155.3 MVA	Confirmed
2.3	Generator weighted average efficiency at rated voltage and frequency in line with PTS clause no. 5.4.2, upto "1" decimal place	%	Not less than 98.5%	Confirmed

URI I STAGE II HYDROELECTRIC PROJECT

Volume III C
(TDS)

1 GENERAL TECHNICAL REQUIREMENTS

1.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
B.	**Layout/ Control Dimension / Other Parameters**			
1	Elevation of Centre line of unit	m	1228.7	Confirmed
2	Unit spacing	m	20	Confirmed
3	Generator barrel dia (ID), not more than	m	9.4	Confirmed
4	Elevation of crane beam	m	1251	Confirmed
5	Elevation of roof (truss)/crown top	m	1260	Confirmed
6	Elevation of service bay	m	1239.8	Confirmed
7	Adequacy of height of service bay to crane beam level with reference to lifting of rotor/stator/ heaviest/ biggest assembly of turbine/ generator/MIV/ transformer	m	not more than 11.2 m	Confirmed
8	Adequacy of height of unloading bay in transformer cavern to crane beam level with reference to lifting of GSU Transformer	m	not more than 11.2 m	Confirmed
9	Adequacy of height of unloading bay in transformer cum GIS cavern to crane beam level with reference to lifting of Switchgear equipment	m	not more than 21 m	Confirmed
10	Number of floors in control block	no.	6	Confirmed
11	Dimension of service bay (L X W)	mxm	26 X 20	Confirmed
12	Size of Power house (L X W X H)	mxmxm	91 X 20 X 42.8	Confirmed
13	Size of Transformer cavern (L X W X H)	mxmxm	109 X 16.5X 26.5	Confirmed
14	Size of Control Block (L X W X H)	mxmxm	17 X 20 X 27.2	Confirmed
15	Size of GIS hall (L X W X H)	mxmxm	101.8 X 16.5X 14.5	Confirmed
16	Whether all the dimensions generally confirm to bid drawing dimensions	-	Yes	Confirmed
17	Any deviation recorded in the bid dimensions or any special/additional requirement	-	No	Confirmed
18	Wether Transportation weight of the Transformer complied to 70R specification as per ITB or not?	-	Yes	Confirmed
19	Confirmation of Provision as per Clause no. 1.5.1.8 of GTR	-	Yes	Confirmed
20	Confirmation of Provision of hatch covers and other covering etc. as per Clause no. 4.11.2 of GTS	-	Yes	Confirmed
21	Confirmation of compliance to Central Electricity Authority (Latest Technical Standards for Construction of Electrical Plants and Electric Line) Regulations and latest CERC norms at the time of supply.	-	Yes	Confirmed

URI I STAGE II HYDROELECTRIC PROJECT

Volume III C
(TDS)

1 GENERAL TECHNICAL REQUIREMENTS

1.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
B.	**Layout/ Control Dimension / Other Parameters**			
22	Complete Compliance of specification	-	Yes	Confirmed

2 TURBINE AND ACCESSORIES

2.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
A.				
1	Type/ designation	-	Vertical shaft Francis	Confirmed
1.1	Turbine output	MW	Minimum 121.827 MW	Confirmed
1.1.1	Rated speed of the Turbine	rpm	333.33 rpm	Confirmed
1.1.2	Turbine rated output at rated net head of 227 m within 85% guide vane opening and at rated speed of 333.33 rpm	MW	Minimum 121.827 MW	Confirmed
1.1.3	Turbine rated output at rated net head of 227 m with full guide vane opening and at rated speed of 333.33 rpm	MW	Minimum 134 MW	Confirmed
1.1.4 (a)	Turbine weighted average efficiency at rated head with coated runner in line with PTS clause no. 2.4.2, upto "1" decimal places.	%	Minimum 94	Confirmed
1.1.5	Maximum Speed rise at synchronous speed i.e. 333.33 rpm caused by load rejection from full gate output to zero and under any worst condition	%	not more than 55	Confirmed
2	Maximum water hammer over-pressure at static head of 262.3 m at full gate output rejection of any of the units and under any worst condition	%	not more than 29	Confirmed
3	Maximum noise level at any place at distance of 1 m	dB(A)	not more than 90	Confirmed
4	**Maximum guide bearing temperature under permissible operating range of turbine**			
4.1	Metal temperature	°C	not more than 70	Confirmed
4.2	Oil temperature	°C	not more than 65	Confirmed
4.3	Capability of guide bearing to withstand			Confirmed
4.3.1	at runaway speed with cooling water	minutes	15 (minimum)	Confirmed
4.3.2	at rated speed without cooling water	minutes	15 (minimum)	Confirmed
5	**Spiral casing +Stay Ring**			Confirmed
5.1	Design Pressure	kg/cm2	minimum 35.5	Confirmed
5.2	Test Pressure	kg/cm2	minimum 53.3	Confirmed

2 TURBINE AND ACCESSORIES

2.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
6	Thickness of pitliner	mm	As per PTS Clause 2.5.4.4	Confirmed
7	Thickness of replaceble type facing plates	mm	minimum 30	Confirmed
8	Flow measurement system			
8.1	Winter – Kennedy flow measurement system	-	Yes	Confirmed
8.2	Ultrasonic continuous on-line flow measurement system	-	Yes	Confirmed
8.2.1	Min. eight (8) sets of transducers paths for ultrasonic flow measurement	-	Yes	Confirmed
9	Portable optical type silt measuring instruments	-	Yes	Confirmed
10	Self Lubrication bearing system for GV bushes	-	Yes	Confirmed
11	Capability of guide bearing to withstand the additional stresses resulting from operation of unit with three adjacent guide vanes in closed position	-	Yes	Confirmed
12	Standards			
12.1	Applicable standard for system and equipment	-	As per PTS Clause no 2.5.1	Confirmed
13	**Material standard / class / Grade / Type**			
13.1	Runner	-	As per PTS clause 2.5.3	Confirmed
13.2	Runner cone			Confirmed
13.3	Rotating labyrinth (upper) & (lower)			Confirmed
13.4	Fixed labyrinth (upper) and (lower)			Confirmed
13.5	Shaft seal sleeve/liner			Confirmed
13.6	Guide vanes			Confirmed
13.7	Bottom ring			Confirmed
13.8	Head cover			Confirmed
13.9	Discharge ring			Confirmed
13.10	Draft tube cone			Confirmed
13.11	Spiral casing			Confirmed
13.12	Stay ring			Confirmed
13.13	Turbine shaft			Confirmed
14	Minimum limit of supply of Draft Tube liner and its thickness	-	As per PTS Clause 2.5.4.3	Confirmed
15	Cavitation pitting guarantee based on PTS Clause 2.4.3	-	Yes	Confirmed

2 TURBINE AND ACCESSORIES

2.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
16	If Spiral casing concreting is done in depressurised condition then woolfelt sheet of minimum thickness 40mm shall be used.	-	Yes	Confirmed
17	Shaft seal (axial, water lubricated, hydro dynamically balanced and automatic self adjusting)	-	Yes	Confirmed
18	Metal acoustic access door for turbine pit access and runner removal gallery	-	Yes	Confirmed
19	Model testing	-	As per PTS clause2.4.6	Confirmed
20	Field efficiency test by the thermodynamic method.	-	Yes	Confirmed
21	3 mm corrosion and abrasion allowance in the thickness of spiral casing	-	Yes	Confirmed
22	Bolted arrangement for labyrinth	-	Yes	Confirmed
23	Bearing pad area minimum as percentage of journal contact area	-	preferably 60%	Confirmed
24	Complete Compliance of specification	-	Yes	Confirmed
25	Hard Coating provided as per PTS clause 2.5.9	-	Yes	Confirmed

3 DIGITAL GOVERNING SYSTEM AND ACCESSORIES

3.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
A.				
1	Type / designation	-	Digital electronic-hydraulic governing system	Confirmed
2	Speed stability index	%	no more than 0.3	Confirmed
3	Power stability index	%	no more than 0.4	Confirmed
4	Maximum speed rise on full load rejection (% of rated speed)	%	not more than 43	Confirmed
5	Maximum pressure rise at static head on total load rejection	%	not more than 23	Confirmed
7	Range of closing time to limit the guaranteed speed rise and pressure rise	sec	6 to 20 sec	Confirmed
8	**Characteristic Data**			
8.1	Range of adjustment of permanent speed droop	%	0-10	Confirmed
8.2	Range of adjustment of temporary speed droop	**%**	Adjustable between 0-100	Confirmed
8.3	Sensitivity of governor to respond to minimum speed change of rated speed	%	Not more than 0.01 % of rated	Confirmed
8.4	Range of adjustment of guide vane opening time	sec	upto 60	Confirmed
8.5	Range of adjustment of guide vane closing time	sec	Upto 20	Confirmed
8.6	Speed dead band	%	not to exceed 0.02%	Confirmed
8.7	Governor dead time	sec	0.2	Confirmed
8.8	Speed changer adjustable range(no load)	%	90 -110	Confirmed
8.9	Speed changer time setting	sec	adjustable ramp rate of 10 to 500	Confirmed
8.10	Power changer(controller) adjustable range	%	0 to 100	Confirmed
9	**Digital Controller**			
9.1	Proportional gain	-	0.1 to 20	Confirmed
9.2	Integral time	sec	0.1 to 20	Confirmed
9.3	Derivative gain	-	1 to 10	Confirmed

3 DIGITAL GOVERNING SYSTEM AND ACCESSORIES

3.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
10	**Oil pumping unit**			
10.1	Number of closing opening operations possible at minimum oil pressure without the operation of oil pump and dry Nitrogen admission	-	2 “C”+1 “O”	Confirmed
11	Maximum oil velocity in pressure pipes	m/s	3	Confirmed
12	Maximum oil velocity in return pipes	m/s	1.5	Confirmed
13	**Digital Controller**			
13.1	Is feed forward or ramper device provided	-	Yes	Confirmed
13.2	Fully redudant digital electronic controller provided	-	Yes	Confirmed
13.3	Failure detection feature	-	Yes	Confirmed
14	Transducers/sensors for redundant position feedback provided	-	As per PTS Clause no 3.5.4.2	Confirmed
15	Position feedback mismatch detection function provided	-	As per PTS Clause no 3.5.6.1	Confirmed
16	Hydraulic mechanical overspeed device	-	As per PTS Clause no 3.5.5	Confirmed
17	Provision of emergency control	-	As per PTS Clause no 3.5.6.3	Confirmed
18	Governor operation in RGMO -FGMO	-	As per PTS Clause no 3.2.1	Confirmed
19	Governor operation in condensor mode	-	As per PTS Clause no 3.2.1	Confirmed
20	Applicable standard		As per PTS Clause no 3.5.1	Confirmed
21	Complete Compliance of specification	-	Yes	Confirmed

4 MAIN INLET VALVES AND ACCESSORIES

4.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
A.				
1	Type /designation	-	Spherical	Confirmed
2	Inside diameter of Valve	mm	2800	Confirmed
3	Valve normal operating oil pressure	bars	100 -160	Confirmed
3.1	Medium	-	Nitrogen/oil	Confirmed
4	Adjustment of Closing and opening time of the valve	sec.	60-120	Confirmed
5	Generator	-	2 “C”+1 “O”	Confirmed
6	Design presssure for spherical Valve	bars	38	Confirmed
7	Corrosion and abrasion allowance for valve components	mm	3	Confirmed
8	**Material standard,Class, Grade/Type of**			
8.1	Valve body	-	As per PTS Cl.no. 4.5.3	Confirmed
8.2	Valve disc			Confirmed
8.3	Valve trunnions			Confirmed
8.4	Connection Sleeve			Confirmed
8.5	Permanent seat of seals, seal retainers,maintenance seal and fasteners			Confirmed
8.6	Service seal			
9	Counter weight mounted on trunnion	-	Yes	Confirmed
10	Capability of the valve to open at 50 % unbalance condition	-	Yes	Confirmed
11	Capability of the valve to close at maximum flow rate and maximum gross head of 139.45 m by action of counter weights	-	Yes	Confirmed
12	Self - lubrication	-	Yes	Confirmed
13	Butterfly Valve shall be capable to operate under (detailed as per Enclosure-1) ppm during high flood	-	Yes	Confirmed
14	Maximum leakage from Spherical valve when fully closed			Confirmed
14.1	- through service seal	-	1 lpm/ meter periphery of seal	Confirmed
14.2	- through maintenance seal	-	3 lpm/ meter periphery of seal	Confirmed
15	Spherical Valve OPU oil & bearing oil should be same grade	-	Yes	Confirmed
16	Type, structure and arrangement of Counter weight shall be specifically got approved during detailed engineering.	-	Yes	Confirmed
17	Applicable standard for Butterfly valve	-	IS 7326	Confirmed
18	Complete Compliance of specification	-	Yes	Confirmed

5 GENERATOR

5.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
A.				
1	Generator rated voltage	kV	13.8	Confirmed
1.1	Guaranteed voltage range	-	± 10%	Confirmed
2	Rated frequency	Hz	50	Confirmed
2.1	Guaranteed frequency range	-	(minus) -5% to (plus) +3%	Confirmed
3	Combined voltage and frequency variation	-	less than ±10%	Confirmed
4	Generator	rpm	333.33	Confirmed
5	Generator rated power at rated power factor of 0.85 and at any voltage and frequency in the specified operating range without exceeding the maximum permissible temperature limits	-	Clockwise	Confirmed
6	Inertia constant of complete Generating unit at maximum output (H)	kW-sec/kVA	Not less than 3.75	Confirmed
7	Generator rated power at rated frequency and voltage at 0.85 power factor (lagging)	MVA	Minimum 141.2	Confirmed
8	Generator maximum power at rated frequency/voltage and 0.85 power factor	MVA	Minimum 155.3	Confirmed
9	Generator weighted average efficiency at rated voltage and frequency in line with PTS clause no. 5.4.2, upto "1" decimal places.	%	Not less than 98.5%	Confirmed
10	Runaway speed withstand time	min.	15	Confirmed
11	Lowest factor of safety (referred to yield strength) for a generator rotating parts at runaway speed as per PTS clause no. 1.5.1.1 is Complied	-	Yes	Confirmed
12	Capability of bearings to withstand for			
12.1	runaway speed with cooling water	min.	15 (minimum)	Confirmed
12.2	rated speed without cooling water	min.	15 (minimum)	Confirmed
13	Maximum permissible temperatures under rated Power (120MW) at 0.9 p.f at rated voltage and rated frequency with ambient temperature 40ºC and cooling water inlet temperature 30ºC			
13.1	- stator winding, measured by RTD	° C	105	Confirmed
13.2	- field winding, measured by resistance method	° C	105	Confirmed

5 GENERATOR

5.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
14	Maximum permissible temperatures under rated Power (120MW) at 0.9 p.f at rated voltage and rated frequency with ambient temperature 40ºC and cooling water inlet temperature 30ºC			
14.1	- thrust bearing pad, measured by embedded temperature detector	° C	75	Confirmed
14.2	- guide bearing segments, measured by embedded temperature detector	° C	65	Confirmed
15	Generator short-circuit ratio	-	Not less than 1.05 at 0.9 pf	Confirmed
16	No. of phases	-	3 Nos.	Confirmed
17	Rated power factor lagging	-	0.85	Confirmed
18	Generator minimum line charging capability of rated continous power	%	Minimum 70%	Confirmed
19	Generator operation in condensor mode	-	Yes	Confirmed
20	Standards			
20.1	Applicable standards for system and equipment	-	As per PTS Clause no 5.5.1	Confirmed
20.2	Material standard / class / Grade / Type			
20.2.1	Structural steel for supports, brackets and components	-	As per PTS clause no. 5.5.2	Confirmed
20.2.2	Stator frame			Confirmed
20.2.3	Rotor spider			Confirmed
20.2.4	Rotor rim			Confirmed
20.2.5	Rotor pole lamination			Confirmed
20.2.6	Brake ring			Confirmed
20.2.7	Generator shaft			Confirmed
20.2.8	Bearing housing			Confirmed
21	Provision of on-line monitoring system for monitoring of			
21.1	Partial Discharge as per PTS Cl. No 5.5.12.4	-	Yes	Confirmed
21.2	Air Gap as per PTS Cl. No 5.5.12.5	-	Yes	Confirmed
21.3	Vibration as per PTS Cl. No 5.5.12.6	-	Yes	Confirmed
22	Compatability with plant SCADA system as per clause no. 5.5.13 of PTS			Confirmed
22.1	Generator control and monitoring	-	Yes	Confirmed
22.2	On-line monitoring systems	-	Yes	Confirmed

5 GENERATOR

5.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
23	Deviation factor of wave form, measured in % from line to line on open circuit at rated voltage and frequency	-	Not more than 5%	Confirmed

5 GENERATOR

5.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
24	Telephone harmonic factor	-	Not more than 1.5%	Confirmed
25	Generator capability to withstand maximum stresses during normal and abnormal condition as specified in PTS clause no. 5.2.2	-	Yes	Confirmed
26	Generator short circuit withstand capability at generator terminal when operated at 165 MVA at rated power factor with ± 10% of rated voltage	-	Not less than 3 seconds	Confirmed
27	Generator capability to withstand occasional excess current equal to 1.5 times rated current	-	Not less than 30 seconds each time	Confirmed
28	Speed at which brakes may be applied			
28.1	in normal operation	-	not more than 30% of rated rpm	Confirmed
28.2	in emergency operation	-	not more than 50% of rated rpm	Confirmed
29	Bearing pad area as percentage of journal area	-	preferably 55-60%	Confirmed
30	Interpole connection	-	bolted type	Confirmed
31	Radial jacks on each arm of upper bracket provided (if required) and compliance of PTS clause No. 5.5.4	-	Yes	Confirmed
32	Generator design for worst (highest) runaway speed for any turbine operation under all heads	-	Yes	Confirmed
33	Allowable over speed (normal operation)	rpm	less than 516.67	Confirmed
34	Weight of the generator rotating parts including shafts	kg	not less than in conformance of H value=3.75	Confirmed
35	Total load on thrust bearing, including rotating turbine parts and hydraulic thrust		approx. 3.5 Mpa for babbited bearing or as per applicability for any other design	Confirmed
36	Complete Compliance of specification	-	Yes	Confirmed

6 STATIC EXCITATION SYSTEM

6.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
A.				
1	Primary Rated Voltage	kV	13.8	Confirmed
2	Class of insulation of Transformer		Minimum 'H' class	Confirmed
3	Rating of Excitation transformer shall be decided during detailed engineering	-	Yes	Confirmed
4	Excitation transformer shall be of the 3-phase, cast-resin, dry type with copper windings	-	Yes	Confirmed
5	Type of Cooling		AN	Confirmed
6	BIL (High Tension)	kV	Min. 95	Confirmed
7	Power frequency withstand voltage	kV	Min. 38	Confirmed
8	Rectifier system with (n+n) layout Thyristor bridge arrangement for 100% redundancy (where 'n' is no.of bridges)	-	Yes	Confirmed
9	Excitation system shall have two 100% excitation channels Auto 1 and Auto 2 including its own independent control system as per PTS clause no. 6.2.1	-	Yes	Confirmed
10	Excitation system shall be able to supply 200% of the rated excitation current for 60 sec. without damage as per clause no. 6.3.1.1 of PTS	-	Yes	Confirmed
11	The positive and negative ceiling voltage shall be minimum 200% and 160% respectively of rated excitation voltage at rated output as per PTS clause no. 6.3.1.1.	-	Yes	Confirmed
12	Type of field discharge resistor	-	Non-Linear	Confirmed
13	Excitation system capability for Synchronous condensor mode operation	-	Yes	Confirmed
14	Excitation system capability for Line charging mode	-	Yes	Confirmed
15	Compliance of latest standards as per PTS clause no. 6.5.1	-	Yes	Confirmed
16	Complete Compliance of Specification	-	Yes	Confirmed

7 13.8 kV Bus Duct

7.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	Nominal system voltage	kV	13.8	Confirmed
2	Highest system voltage	kV	17.5	Confirmed
3	Rated continuous currents			
3.1	- Main bus	A	8000	Confirmed
3.2	- Tap off Bus	A	As per requirement	Confirmed
3.3	- Delta Bus	A	5000	Confirmed
4	Maximum temperature rise above ambient temp. 40^0 C at rated continuous current (all connections)			
4.1	- Bus Conductor	^{0} C	65	Confirmed
4.2	- Out side surface of enclosure	^{0} C	30	Confirmed
5	Rated Power frequency withstand voltage for one minute	kV_{rms}	Min. 38	Confirmed
6	Rated Lightning impulse withstand voltage	kV_{peak}	Min. 95	Confirmed
7	Current transformers:			
7.1	Nominal voltage of equipment	kV	13.8	Confirmed
7.2	Highest voltage for equipment	kV	17.5	Confirmed
7.3	Rated short duration power frequency withstand voltage, 1 min.	kV_{rms}	Min. 38	Confirmed
7.4	Rated lightning impulse withstand voltage	kV_{peak}	Min. 95	Confirmed
8	Potential transformers:			
8.1	Nominal voltage of equipment	kV	13.8	Confirmed
8.2	Highest voltage for equipment	kV	17.5	Confirmed
8.3	Rated short duration power frequency withstand voltage, 1 min.	kV_{rms}	Min. 38	Confirmed

7 13.8 kV Bus Duct

7.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
8.4	Rated lightning impulse withstand voltage	kV_{peak}	Min. 95	Confirmed
9	Material of of bus Conductor	-	Aluminium/ Aluminium alloy	Confirmed
10	Thermal Short time with stand current, 1s (for all connections)	kA_{rms}	in line with PTS clause no 7.3.2	Confirmed
11	Rated Frequency	Hz	50	Confirmed
12	Split phase protection CT rated current	0	**	Confirmed
13	Neutral-end CT rated current	A	8000/5	Confirmed
14	Line-end CT rated current	A	8000/5	Confirmed
15	CT Accuracy Class		PS / 0.2S/5P20	Confirmed
16	PT transformation ratio	-	(13.8/√3) kV / (110/√3) V / (110/√3) V	Confirmed
17	PT Accuracy class	-	3P / 0.2	
18	Appropriate arrangement included in Design /construction for quick linkage / removal of shorting bar/link & easy acess	-	Yes	Confirmed
19	Applicable standards	-	As per PTS Clause no 7.5.1	Confirmed
20	Complete Compliance of specification		Yes	Confirmed

** The current ratio of split phase protection CT shall be decided later as per no. of conductors/slot/phase during detail engineering.

8 GSU TRANSFORMERS

8.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
A.				
1	Rated continuous MVA at max. ambient temperature:	MVA	52	Confirmed
2	Rated voltages			Confirmed
2.1	- HV winding	kV	400/√3	Confirmed
2.2	- LV winding	kV	13.8	Confirmed
3	Highest voltage of equipment Um for			Confirmed
3.1	- HV winding	kV	420/√3	Confirmed
3.2	- LV winding	kV	17.5	Confirmed
4	Maximum temperature rise, at rated power with a reference maximum ambient temperature of 40deg C			Confirmed
4.1	- top oil (measured by thermometer)	^{0} C	45	Confirmed
4.2	- windings (measured by resistance)	^{0} C	50	Confirmed
4.3	Tank hot spot temperature	^{0} C	110	Confirmed
5	Type of cooling	-	OFWF /ODWF	Confirmed
6	GSU Transformer Losses			
6.1	Maximum permissible No-load losses at rated voltage and rated frequency	kW	40	Confirmed
6.2	Maximum permissible Load loss at rated output, rated frequency and corrected for 75°C winding temperature	kW	105	Confirmed
6.3	Maximum permissible Auxilliary losses at the rated output,rated voltage,rated frequency and ambient temperature	KW	4	Confirmed
7	GSU Transformer is a single phase, 50Hz, Separte winding transformer	-	Yes	Confirmed
8	Line terminal AC withstand voltage (LTAC)			
8.1	- HV winding / Bushing	kV (r.m.s)	630/750	Confirmed
8.2	- HV neutral winding / Bushing	kV (r.m.s)	70 / 77	Confirmed
9	Lightning impulse withstand voltage			
9.1	- HV winding / Bushing	kV (Peak)	1425/1550	Confirmed
9.2	- HV neutral winding / Bushing	kV (peak)	170/170	Confirmed
9.3	- LV winding / Bushing	kV (peak)	95/95	Confirmed
10	Switching impulse withstand voltage of H.V Winding and Bushing	kV (peak)	1175	Confirmed
11	Vector group		YNd11	Confirmed
12	% impedance voltage at rated power referred to 75°C winding temperature	-	12.5 % (No -ve tolerance)	Confirmed
13	Short circuit withstand capacity			

8 GSU TRANSFORMERS

8.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
13.1	-Short circuit apparent power	-	As per table-2 of IEC 60076-5	Confirmed
13.2	-Short circuit current for 1 sec. on HV side	kA	63	Confirmed

8 GSU TRANSFORMERS

8.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
14	Max. flux density at rated voltage and frequency	Tesla	Not to exceed 1.7 Tesla	Confirmed
15	Type of Insulatiuon			
15.1	- HV winding	-	Minimum Class A (winding insulation shall be and able to withstand 420kV continuously)	Confirmed
15.2	- LV winding	-	Minimum Class A (Uniformly insulated)	Confirmed
16	Material of the winding conductor	-	Copper	Confirmed
17	No. Of Oil-water Coolers	-	As per Clause 8.5.8.1 of PTS	Confirmed
18	No. Of Oil Pumps	-	As per Clause 8.5.8.1 of PTS	Confirmed
19	Oil Quality	-	As per IEC 60296/IS 335	Confirmed
20	Hotspot Temperature measuring system	-		
20.1	No of fibre sensors in each transformer	-	As per Clause 8.5.21.2 of PTS	Confirmed
20.2	Temperature measuring range	-	0^0 C to 150^0 C	Confirmed
21	Type of Conservator	-	Air Bag type	Confirmed
22	Type of Bushing			
22.1	- HV terminal	-	Oil/SF6 bushing	Confirmed
22.2	- LV Terminal	-	Oil / Air Bushing	Confirmed
22.3	- Neutral Terminal	-	Oil / Air Bushing	Confirmed
23	Continuous on-line moisture-in-oil measuring system & DGA	-	As per Clause 8.5.23 of PTS	Confirmed
24	Rails	-	As per Clause 8.1.1.(iii) of PTS	Confirmed
25	Core material	-	High grade Cold Rolled Non Ageing Grain Oriented Silicon Steel Laminations	Confirmed
26	Buchholtz relay, WTI, OTI, flow switch, SPR & PRD included in supply	-	Yes	Confirmed

8 GSU TRANSFORMERS

8.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
27	Ports for Oil sampling, DGA & Moisture-in-oil system	-	Yes	Confirmed
28	Standards applicable as per PTS clause no. 8.5.1	-	Yes	Confirmed
29	Whether Transportation weight of the Transformer complied to 70R specification as per ITB or not	-	Yes	Confirmed
30	Short circuit testing to be done on one Transformer	-	Yes	Confirmed
31	Provision of nitrogen injection system for transformer fire fighting protection (this is in addition to HV water spray syetm covered in chapter 29 of PTS)	-	Yes	Confirmed
32	Limit of hot spot temperature for which the transformer is designed as per applicable standard	^{0}C	not more than 98^{0}C	Confirmed
33	Applicable standards	-	As per PTS cluase 8.5.1	Confirmed

9 BUS REACTOR

9.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
A.				
1	Rated continuous MVAR at max. ambient temperature:	MVAR	26.67	Confirmed
2	Rated voltages			Confirmed
	winding	kV	420/√3	Confirmed
3	Highest voltage of equipment Um for			Confirmed
	winding	kV	420/√3	Confirmed
4	Maximum temperature rise, at rated power with a reference maximum ambient temperature of 40deg C			
	- top oil (measured by thermometer)	^{0} C	45	Confirmed
	- windings (measured by resistance)	^{0} C	50	Confirmed
	Tank hot spot temperature	^{0} C	110	Confirmed
5	Type of cooling	-	OFWF	Confirmed
6	Bus Reactor Losses			
6.1	Maximum permissible Total Load losses at rated voltage and rated frequency	kW	79	Confirmed
6.2	Maximum permissible Auxilliary losses at the rated output,rated voltage,rated frequency and ambient temperature	kW	4	Confirmed
7	Bus reactor is a single phase, 50Hz, bus connected reactor	-	Yes	Confirmed
8	Line terminal AC withstand voltage (LTAC)			
	winding	kV	383 (with PD) for one hour	Confirmed
	Bushing	kV (r.m.s)	750	Confirmed
	Neutral/Bushing (minimum)	kV (r.m.s)	38/77	Confirmed
9	Lightning impulse withstand voltage			
	winding / Bushing	kV (Peak)	1425/1550	Confirmed
	neutral / Bushing	kV (Peak)	95/170	Confirmed
10	Switching impulse withstand voltage of winding and bushing	kV (Peak)	1175	Confirmed

9 BUS REACTOR

9.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
11	Type of Insulatiuon			
	winding	-	Minimum Class A (winding insulation shall be and able to withstand 420kV continuously)	Confirmed
12	Type of Bushing			
	- HV terminal	-	Oil/SF6 bushing	Confirmed
	- Neutral Terminal	-	Oil / Air Bushing	Confirmed
13	Short circuit apparent power	MVA	40000	Confirmed
14	Max. flux density at rated voltage and frequency	Tesla	Not to exceed 1.7 Tesla	Confirmed
15	Material of the winding conductor	-	Copper	Confirmed
16	Oil Quality	-	As per IEC 60296/IS 335	Confirmed
17	Hotspot Temperature measuring system	-	Yes	Confirmed
18	Temperature measuring range	-	0^0 C to 150^0 C	Confirmed
19	Type of Conservator	-	Air Bag type	Confirmed
20	Rails	-	As per Clause 9.1.1.(iii) of PTS	Confirmed
21	Core material	-	HIgh grade Cold Rolled Non Ageing Grain Oriented Silicon Steel Laminations	Confirmed
22	Buchholtz relay, WTI, OTI, flow switch, SPR & PRD included in supply	-	Yes	Confirmed
23	Ports for Oil sampling, DGA & Moisture-in-oil system	-	Yes	Confirmed
24	Standards applicable as per PTS clause no. 9.5.1	-	Yes	Confirmed
25	Whether Transportation weight of the Reactor complied to 70R specification as per ITB or not	-	Yes	Confirmed
26	Provision of nitrogen injection system for reactor fire fighting protection (this is in addition to HV water spray system covered in chapter 29 of PTS)	-	Yes	Confirmed
27	Limit of hot spot temperature for which the reactor is designed as per applicable standard	^{0}C	not more than 98^0C	Confirmed

10 XLPE CABLE

10.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	Applicable Standard	-	IEC 62067	Confirmed
2	Main data (applicable to cables and accessories)			
2.1	Rated system voltage	kV	400	Confirmed
2.2	Highest voltage for equipment Um	kV	420	Confirmed
2.3	Frequency	Hz	50 ± 5 %	Confirmed
2.4	Rated withstand voltage to earth of cable and cable sealing			
	- Power frequency(rms) for 60 min.	kV	440	Confirmed
	- Lighting Impulse(peak value)	kV	1425	Confirmed
	- switchting Impulse	kV	1050	Confirmed
2.5	Maximum partial discharge in line with IEC 62067	pC	5	Confirmed
2.6	Maximum permissible operating temperatures at			
	- continuous rated operation	°C	90	Confirmed
	- short-circuit condition(5 sec max)	°C	250	Confirmed
2.7	Cable construction			
2.7.1	- conductor cross section			
2.7.1.1	GIS to Pothead Yard	mm^2	2000	Confirmed
2.7.1.2	Interconnection GIS of Uri Stage 1 & 2	mm^2	2000	Confirmed
2.7.2	- conductor material	-	Copper	Confirmed
2.7.3	- type of screen	-	Wire/ Corrugated/tape	Confirmed
2.7.4	- bending radius	-	not more than 23 x Outer dia.	Confirmed
2.7.5	- screen material	-	Copper/ Al	Confirmed
2.7.6	- internal semi-conductor material	-	XLPE semi-conducting shield	Confirmed
2.7.7	- insulation material	-	XLPE	Confirmed
2.7.8	- external semi-conductor material	-	XLPE semi-conducting shield	Confirmed
2.7.9	- outer sheath material	-	PE with HFFR layer	Confirmed
2.8	Rated continuous current			
2.8.1	GIS to Pothead yard	A	1800	Confirmed
2.8.2	GIS Uri I to GIS Uri St II	A	1800	Confirmed
2.9	short time withstand current 1s			
	- of conductor	kArms	63	Confirmed
	- of screen	kArms	63	Confirmed
2.10	Dynamic short circuit withstand current	kApeak	157.5	Confirmed
2.11	GIS cable sealing ends :			
2.11.1	Type	-	prefabricated joint	Confirmed
2.12	Transformer cable sealing ends :			
2.12.1	Type	-	prefabricated joint	Confirmed
2.13	Complete Compliance of specification		Yes	Confirmed

11 GAS INSULATED SWITCHGEAR

11.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1.1	Standard		IEC-62271(all sections)	Confirmed
1.2	Rated Voltage Un	kV	420	Confirmed
1.3	Rated Frequency in			
	-Normal condition	Hz	50	Confirmed
	-Exceptional Condition	Hz	As per IEC 62271-203	Confirmed
1.4	Power frequency withstand voltage, (One) 1 minute			
	- Phase to ground	kV rms	650	Confirmed
1.5	Lightning impulse withstand voltage			
	- against ground	kV	1425	Confirmed
	-across the isolating distance	kV	1425(+240)	Confirmed
1.6	Switching impulse withstand voltage			
	- against ground	kV	1050	Confirmed
	,- between phases	kV	1575	Confirmed
	-across the isolating distance	kV	900(+345)	Confirmed
1.7	Maximum partial discharge of switch gear assembly	-	In line with IEC 62271-203	Confirmed
1.80	Maximum leakage rate in percent of the respective volume, per year	%	0.10%	Confirmed
1.10	Minimum symmetrical short-time withstand current, (One) 1 second	kA	63	Confirmed
1.11	Minimum peak short-circuit withstand current	kA	157.5	Confirmed
1.12	**Circuit Breaker**			
1.12.1	Standard		IEC 62271-100	Confirmed
1.12.2	Rated continuous current	A	4000	Confirmed
1.12.3	Rated symmetrical short-circuit breaking current	kA	63	Confirmed
1.12.4	Rated short-circuit making current	kA	157.5	Confirmed
1.12.5	Line charging current breaking capability	A	400	Confirmed
1.12.6	Small inductive current breaking capability (without producing excessive over voltages)	A	As per IEC 62271-110	Confirmed
1.12.7	Operating sequence			
	- Line breakers	-	O-0.3s-CO-3 min–CO	Confirmed
	- Generator feeder & bus coupler breakers	-	O-3min-CO-3 min–CO	Confirmed
1.12.8	Total breaking time	ms	<40 ms	Confirmed
1.12.9	Total closing time	ms	<100 ms	Confirmed
1.12.10	First pole to clear factor	-	1.3	Confirmed
1.12.11	Operating Mechanism	-	Spring/hydraulic/ other	Confirmed
1.12.12	Compliance to Class C2 and M2	-	Yes	Confirmed

11 GAS INSULATED SWITCHGEAR

11.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1.12.13	Minimum number of operations at full short circuit rating	-	as per IEC /CEA guidelimes	Confirmed
1.12.14	DC offset current and time constant		58%,45 ms	Confirmed
1.13	**Disconnector**			
1.13.1	Standard	-	IEC 62271-102	Confirmed
1.13.2	Rated continuous current	A	4000	Confirmed
1.13.3	Minimum make and break capability for capacitive current	A	0.5	Confirmed
1.13.4	Total operating time (closing or opening cycle)	-	As per accepted international practice	Confirmed
1.14	**Fast Acting Grounding Switch**			
1.14.1	Standard	-	IEC 62271-102	Confirmed
1.14.2	Rated short-circuit making current (peak)	kA	157.5	Confirmed
1.14.3	Rated switching capacity			
	- inductive currents/voltage	-	160A/10 kV	Confirmed
	- capacitive currents/voltage	-	18A/20 kV	Confirmed
1.14.4	Total operating time (closing or opening cycle)	-	As per accepted international practices	Confirmed
	- fast acting time	-	As per accepted international practices	Confirmed
1.15	**Safety Grounding Switch**			
1.15.1	Standard	-	IEC 62271-102	Confirmed
1.15.2	Rated short time withstand current, (One) 1 s	kA	63	Confirmed
1.15.3	Total operating time(closing or opening cycle)	-	As per accepted international practices	Confirmed
1.16	**Bus Voltage Transformers**			
1.16.1	Standard	-	IEC 61869-3	Confirmed
1.16.2	Rated transformation ratio			
	- for protection	-	(400/√3)kV/(110/√3) V	Confirmed
	- for metering	-	(400/√3)kV/(110/√3) V	Confirmed
1.16.3	Accuracy class / rated burden			
	- for protection	-	3P	Confirmed
	- for metering	-	0.2	Confirmed
1.17	**Surge Arrestor**			
1.17.1	Standard	-	IEC 60099-4	Confirmed
1.17.2	System voltage	kV	420	Confirmed
1.17.3	rated arrestor voltage	kV	336	Confirmed

11 GAS INSULATED SWITCHGEAR

11.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1.17.4	rated nominal discharge current	kA	20	Confirmed
1.17.5	Minimum continuous operating voltage (COV)	kV	267	Confirmed
1.17.6	One minute (dry) power frequency withstand voltage of arrestor housing	kV	630	Confirmed
1.17.7	Impulse withstand voltage of arrestor housing with 1.2/50 ms wave	kV	1425	Confirmed
1.18	**Current Transformer**			Confirmed
1.18.1	Standard	-	IEC 61869-2	Confirmed
1.18.2	Current ratio	-		
	-Generator Transformer bay/ Line bay/Bus coupler bay	-	2000-1000-300A/1A	Confirmed
	-Reactor bay	-	2000-1000-300/1A for Bus bar Protection core and 500-200/1A for other cores	Confirmed
1.18.3	Accuracy class	-		
	For protection	-	PS	Confirmed
	For metering	-	0.2S	Confirmed
1.19	**SF6 properties**			
	Standard	-	IEC 60376	Confirmed
	Water	-	<5 PPM	Confirmed
	Carbon Tetra Fluoride	-	<250 PPM	Confirmed
	Air	-	<250 PPM	Confirmed
1.20	**Partitioning Provision**			
1.20.1	Compliance with IEC 62271-203 Annex -F	-	Yes	Confirmed
1.20.2	Provision of partioning so that maintenance of one bus with other bus in operation	-	Yes	Confirmed
1.20.3	Provision of partioning so that maintenance of one feeder with adjecent feeders in operation	-	Yes	Confirmed
1.21	Gas monitoring system with provision of alarm and tripping and integration with plant scada system	-	Yes	Confirmed
1.21.1	Parameters monitored:			
	Gas Density	-	Yes	Confirmed
	Gas Pressure	-	Yes	Confirmed
	Leakage	-	Yes	Confirmed
	SF_6 gas pressure alarm system	-	Yes	Confirmed
1.22	Online partial discharge measuring system with UHF couplers and integration with plant scada system	-	Yes	Confirmed

11 GAS INSULATED SWITCHGEAR

11.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1.24	Gas processing system	-	Yes	Confirmed
1.25	Interlocking of operation of CB, Isolator and earthing switch	-	Yes	Confirmed
1.26	Conformance to IEC 60859/ IEC 62271-209:2007 for cable connection for GIS	-	Yes	Confirmed
1.27	Complete Compliance of specification	-	Yes	Confirmed
1.28	Design of GIS including Provision of universal interfacing for extension of GIS with GIS of any other make/model. Refer PTS clause no. 11.5.2 and 11.6.2	-	Yes	Confirmed

12.0 POTHEAD YARD

NOT APPLICABLE

13 DC SYSTEM

13.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	**220 V battery charger**			
1.1	Type	-	Float & Boost	Confirmed
1.2	Power supply	-	415V±10%, 3Φ, 4 wire	Confirmed
1.3	DC rated voltage U_N per cell			
	- Boost charger	V	During detailed engineering based on type of battery	Confirmed
	- Float charger	V		Confirmed
1.4	DC rated current I_N			
	- Boost charger	A	During detailed engineering based on type of battery	Confirmed
	- Float charger	A		Confirmed
1.5	Maximum ripple of output voltage (peak to peak)			
	- with the battery connected	% U_N	<1% rms	Confirmed
	- without the battery connected	% U_N	<1% rms	Confirmed
1.6	Protection class of cubicle		IP-42	Confirmed
1.7	Power Factor		Min 0.9 at rated load	Confirmed
1.8	Type of Charger		SCR based/SMPS(power MOSFET based)	Confirmed

13 DC SYSTEM

13.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
2	**220V DC battery**			
2.1	Type	-	Lead Acid Plante / Ni-Cd (FNC) type/ Pocket plate high discharge type (KOH)	Confirmed
2.2	Battery capacity at 27°C at 10 hours	Ah	1000 Ah / 800Ah	Confirmed
2.3	Number of cells per battery bank	Nos.	During detailed engineering based on type of battery	Confirmed
2.4	Voltage per cell	V		
2.5	Rated voltage U_N	V	220	Confirmed
2.6	Float charging voltage	V	During detailed engineering based on type of battery	Confirmed
2.7	Normal charging current	A		
2.8	Boost Voltage	V		
2.9	Discharge end voltage	V		
2.10	Battery rack should be earthquake resistant	-	Yes	Confirmed
3	**220 V DC main distribution board**			
3.1	Type/designation	-	Free standing	Confirmed
3.2	Protection class of cubicle	-	IP52	Confirmed
4	**48V DC distribution board with redundant 220V/48 Volt DC-DC converters**			
4.1	Type designation	-	Free standing	Confirmed
4.2	Protection class of cubicle	-	IP52	Confirmed
4.3	Redundant DC-DC converter rating	A	Min 60	Confirmed
5	**Inverter**			
5.1	Type designation/ capacity	-	Static	Confirmed
5.2	DC supply			
	- input voltage	V	220 V DC	Confirmed
	- maximum admissible variation of input voltage	%	10% / -20%	Confirmed
5.3	AC output			
	- rated voltage UN	V	415	Confirmed
	- number of phases	-	3	Confirmed
	- rated output	kVA	10	Confirmed
5.4	Short time overload capability for 100 ms	% I_N	2 times rated current	Confirmed
5.5	Maximum distortion factor of voltage wave form	%	5% THD at linear load & 7% THD at 100% non linear load	Confirmed
6	Compliance of latest standards as per PTS clause no. 13.5.1	-	Yes	Confirmed
7	Complete Compliance of Specification	-	Yes	Confirmed

14 CONTROL AND MONITORING SYSTEM

14.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	**General**			
1.1	Type	-	Distributed and independent control modules in hierarchical control levels.	Confirmed
1.2	Number of system levels	-	4 (including LCC, UCB, Plant SCADA & Remote)	Confirmed
2	Performance Data			
2.1	System Guaranteed response times			
2.1.1	Order response time	ms	≤ 500 msec	Confirmed
2.1.2	Alarm response time	ms	≤ 1 msec	Confirmed
2.1.3	Event response time	ms	≤ 1 msec	Confirmed
2.2	Overall control and monitoring system availability for top order event "Availability to retrieve all process data from LCBs and operate all breakers"	%	≥ 99.98	Confirmed
2.3	Availability of data channel for real time, full duplex transmission at the rate of 1Gbps between two remote stations	%	≥ 99.99	Confirmed
2.4	Availability of expert for 1 year from date of commissioning of first unit	-	Yes	Confirmed
2.5	Accuracy of Energy Meters		0.2S	Confirmed
2.6	System operation in all stable states	-	Yes	Confirmed
2.7	NAS devices shall have open architecture to connect them to others vendor's equipment	-	Yes	Confirmed
2.8	The control room system shall have the following provisions	-		Confirmed
	- Scaleable (for future extensions)	-	Yes	Confirmed
	- backward compatibilty & interoperability with other sub-system including multi-vendor platform	-	Yes	Confirmed
	- Ease of maintenance	-	Yes	Confirmed
	- Service availbility & adaptability for future technolgy developments	-	Yes	Confirmed
2.90	The overall control & monitoring system shall comply with IEC 60870-5 and interface with protection system at IEC 61850	-	Yes	Confirmed

14 CONTROL AND MONITORING SYSTEM

14.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
2.10	The network equipment shall have a high level of security features in order to prevent any kind of external intrusion / hacking event into system	-	Yes	Confirmed
2.11	The control system shall have both physical & functional or operational redundancies	-	Yes	Confirmed
2.12	All necessary works including supply / laying of OFC & fibre splicing / terminations at the pothead yard / PH control room / Dam control room/route survey are included	-	Yes	Confirmed
3	Characterstic Data			
3.1	Number of local Control Boards	-	As per PTS clause no. 14.1.1	Confirmed
3.1.1	Type of interfaces / ports provided at Local Control Boards for connection with mobile engineering stations	-	Yes	Confirmed
3.2	Human Machine Interface - operator panels	-	Yes	Confirmed
3.3	Number of various operating desks to be provided in the Central Control Room with all necessary accessories	Nos.	as per PTS clause no. 14.1.2	Confirmed
3.4	Optical Fiber			
3.4.1	Type of Laying	-	As per PTS Cl. No. 14.1.4, 14.1.5 & 14.1.6	Confirmed
3.4.2	Optical Fiber core/cladding diameter	µm/µm	As per IEC 60793	Confirmed
3.4.3	Type of cable used within power house	-	DWMM	Confirmed
3.4.4	Type of optical fibre used between P/H & administrative building	-	ADSS ,DWSM (12 cores)	Confirmed
3.4.5	Type of cable used between power house of Uri I Stg 2 and And Uri I Stg I	-	ADSS,DWSM(12 cores)	Confirmed
3.4.6	Number of cores for optical fibre cable provided for communication between power house of Uri I Stg 2 and And Uri I Stg I	Nos.	12	Confirmed
3.5	Type of communication ports	-	Serial ethernet / parallel	Confirmed
3.6	Method of clock synchronization with GPS clock reference	IRIG-B / PPM etc	IRIG-B/SNTP/RS232/PPM/PPS	Confirmed
3.7	Large Screen Display			
3.7.1	Type	-	LED	Confirmed

14 CONTROL AND MONITORING SYSTEM

14.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
3.7.2	Diagonal length of Large Screen Display	Inches	Two 85 inch smart HD - LED TV display with display controller	Confirmed
3.7.3	Screen Resolution of LSD	pixels	3840 X 2160	Confirmed
3.7.4	Display Controller provided with software	-	Yes	Confirmed
3.8	NAS & Storage media provided for archival purposes	-	As per PTS Cl. No. 14.1.2 (xi),	Confirmed
3.9	Networks of the Control System			
3.9.1	Power house LAN			
3.9.1.1	- Type	-	Ethernet	Confirmed
3.9.1.2	- Data transfer rate	Gbps	1Gbps	Confirmed
3.9.2	Control Room Network			
3.9.2.1	- Data transfer rate	Gbps	1Gbps	Confirmed
3.9.3	Plant Control Network			
3.9.3.1	- Type	-	Fiber Optic	Confirmed
3.9.3.2	- Data transfer rate	Gbps	1Gbps	Confirmed
3.10	GPS system provided	-	Yes	Confirmed
3.11	Protection class of panel enclosures (IP class)	-	IP 52	Confirmed
3.12	Compliance of latest standards as per PTS clause no. 14.5.1	-	Yes	Confirmed
4	Complete Compliance of Specification	-	Yes	Confirmed

15 PROTECTION SYSTEM

15.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	**General**			
1.1	Protection class of cubicle IP54	-	Yes	Confirmed
1.2	Type of Protection relays Numerical	-	Yes	Confirmed
1.3	Redundancy in Protection scheme as per SLD	-	Yes	Confirmed
1.4	Conforming to IEC 60255	-	Yes	Confirmed
1.5	Test blocks in panels provided	-	Yes	Confirmed
1.6	Communication with plant control at IEC 61850	-	Yes	Confirmed
1.7	Main-1 & Main-II protection on different DC sources	-	Yes	Confirmed
1.8	Line Main-1 & Main-II protection through different principle/ type	-	Yes	Confirmed
1.9	All protections covered as per scope/specification mentioned in PTS	-	Yes	Confirmed
2	**Numerical Relays**			
2.1	Event logger provided	-	Yes	Confirmed
2.2	DR provided	-	Yes	Confirmed
2.3	RS 232/ usb/ RS 485 ports provided	-	Yes	Confirmed
2.4	Time synchronisation feature provided	-	Yes	Confirmed
2.5	Numerical relays with front panel display	-	Yes	Confirmed
2.6	IEC 61850 compliant	-	Yes	Confirmed
3	Compliance of latest standards as per PTS clause no. 15.5.1	-	Yes	Confirmed

16 CABLING SYSTEM

16.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	**11 KV Power Cables**			
1.1	Type	-	11kV (UE), XLPE , FRLSH	Confirmed
1.2	Rated voltage	kV	11	Confirmed
1.3	Insulation			Confirmed
1.3.1	Material of insulation	-	XLPE	Confirmed
1.4	Conductor			Confirmed
1.4.1	Material of conductor	-	Copper	Confirmed
1.4.2	Form of conductor (circular/shaped)	-	Standard circular	Confirmed
1.5	Screen		Yes	Confirmed
1.5.1	Type of screen	-	Extruded	Confirmed
1.5.2	Material of screen	-	Copper	Confirmed
1.6	Armour provided		Yes	Confirmed
1.6.1	Material	-	Aluminium	Confirmed
1.7	Short circuit current rating for 1 sec	kA	25	Confirmed
2	**Low Voltage Power Cables**			
2.1	Type	-	XLPE , FRLSH	Confirmed
2.2	Rated Voltage	kV	1.1	Confirmed
2.3	Insulation			Confirmed
2.3.1	Material of insulation	-	XLPE	Confirmed
2.4	Conductor			Confirmed
2.4.1	Material of conductor	-	Aluminium / Copper	Confirmed
2.4.2	Form of conductor (circular/shaped)	-	Standard circular	Confirmed
3	**Control and Instrumentation Cables**			
3.1	Type	-	PVC, FRLSH	Confirmed
3.2	Voltage rating	V		Confirmed
3.2.1	Control cable	V	min 1100	Confirmed
3.2.2	Instrumentation cable		min 500	Confirmed
3.3	Conductor			Confirmed
3.3.1	Material of conductor	-	Copper	Confirmed
3.3.2	Form of conductor (circular/shaped)	-	Annealed	Confirmed
3.4	Insulation			Confirmed
3.4.1	Material of insulation	-	PVC	Confirmed
4	**Cable Trays(all Type)**			
4.1	Type	-	Perforated / Ladder	Confirmed
4.2	Material	-	MS fully galvanised / SS where required	Confirmed
4.3	Minimum thickness of cable trays	mm	2	Confirmed
5	Compliance of latest standards as per PTS clause no. 16.5.1	-	Yes	Confirmed
6	Complete Compliance of Specification	-	Yes	Confirmed

17 MV SWITCHGEAR AND STATION AUXILIARY TRANSFORMER

17.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	**General**			
1.1	Type /Designation	-	VCB Drawout	Confirmed
1.2	Highest voltage for equipment Um	kV	12	Confirmed
1.3	Rated short duration power frequency withstand voltage, 1 min.	kVrms	28	Confirmed
1.4	Rated lightning impulse withstand voltage	kV	75	Confirmed
2	**Switchgear cubicles (P/H and Potyard)**			
2.1	Insulation medium	-	Air	Confirmed
2.2	Rated current of bus bar	A	630	Confirmed
2.3	Rated short time withstand current, 1 s	kArms	25	Confirmed
2.4	Short time dynamic withstand current	kApeak	62.5	Confirmed
2.5	Conductor material	-	Copper	Confirmed
2.6	Material of enclosures	-	Cold rolled sheet steel	Confirmed
2.7	Rated voltage	kV	11	Confirmed
2.8	Rated frequency	Hz	50	Confirmed
3	**Circuit breakers**			
3.1	Arc quenching medium	-	Vacuum	Confirmed
3.3	Rated short-circuit breaking current (symmetrical)	kArms	25 KA for 1 sec	Confirmed
3.4	Rated short-circuit making current	kApeak	62.5	Confirmed
3.5	Rated operating sequence	-	O-.3S-CO-3min-CO	Confirmed
3.6	Operating mechanism			
	- for closing	-	Motor charged spring operated	Confirmed
	- for opening	-	Spring operated	Confirmed
4	**Unit tap off transformers(UTT) 13.8 kV / 11kV(Dry type)**			
4.1	Transformer rated voltages at rated frequency and no-load			
	- Primary side, principal tapping	kV	13.8	Confirmed
	- Primary Side, extreme plus tapping	kV	14.49	Confirmed
	-Primary Side extreme minus tapping	kV	13.11	Confirmed
4.2	Number of taps on Primary side winding	Nos.	5	Confirmed
4.3	Short duration separate source power frequency withstand voltage, 1 minute (HV side)	kVrms	38	Confirmed

17 MV SWITCHGEAR AND STATION AUXILIARY TRANSFORMER

17.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
4.4	Short duration separate source power frequency withstand voltage, 1 minute (LV side)	kVrms	28	Confirmed
4.5	Lightning impulse withstand voltage for HV winding	kVpeak	95	Confirmed
4.6	Lightning impulse withstand voltage for LV winding	kVpeak	75	Confirmed
4.7	Transformer continuous three-phase power rating on any tapping	kVA	4000	Confirmed
4.8	Maximum temperature rise in winding at rated power, frequency and on tap producing highest losses (measured by resistance)	^{o}C	100 degree over ambient of 40 ^{o}C	Confirmed
4.9	Minimum percentage impedance at principal tapping and at rated power & rated frequency(referred to 75°C)	%	7	Confirmed
4.1	Vector group	-	Dyn11	Confirmed
4.11	Type of cooling	-	AN	Confirmed
4.12	Class of insulation	-	H	Confirmed
4.13	Nominal currents at principal tapping			Confirmed
	- Primary winding	A	167.35	Confirmed
	-Secondary winding	A	221	Confirmed
4.14	No- load current at rated voltage & frequency	A	1.5% approx.	Confirmed
4.15	Compliance of latest standards as per PTS clause no. 17.5.1	-	Yes	Confirmed
4.16	Complete Compliance of Specification	-	Yes	Confirmed

18 DG SETS

18.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	Type	-	Diesel, 4 stroke, sound proof	Confirmed
2	**Diesel engine**			
2.1	Engine overload capacity (output) for one hour	kW	10% in excess of its rated output at its rated speed for a period of one hour in any period of 12 hours consecutive running	Confirmed
3	**Generator**			
3.1	Rated generator output	kVA	1000	Confirmed
3.2	Rated voltage	kV	11	Confirmed
3.3	Rated power factor	-	0.8 lag	Confirmed
3.4	Overload capacity	%	50% excess for 15 sec.	Confirmed
3.5	Temperature rise of field winding above ambient air temperature at rated output	^{o}C	Limited to Class F Insulation	Confirmed
3.6	Temperature rise of armature winding above ambient temperature at rated output	^{o}C	Limited to Class F Insulation	Confirmed
3.7	Maximum starting time (from starting signal up to full output)	sec	10 sec.	Confirmed
3.8	Variation in terminal voltage	%	5%	Confirmed
3.9	Variation in frequency	%	3%	Confirmed
4	Digital Governor, AMF	-	Yes	Confirmed
5	Automatic start & synchronisation	-	Yes	Confirmed
6	Diesel consumption at full load & at no load	Ltr /hr	To be decided during detailed engg	Confirmed
8	Compliance of latest standards as per clause no. 18.5.1	-	Yes	Confirmed
9	Capacity of Battery is 300AH with battery charger	-	Yes	Confirmed

19 LV SWITCHGEAR AND AUXILIARY TRANSFORMERS

19.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	**415V Switchgear**		UAB/SSB/MISC-BOARD	Confirmed
1.1	System voltage for equipment Um	V	As per PTS cluase 19.3	Confirmed
1.2	Power frequency withstand voltage, 1 minute			
	- main circuits	V	2500	Confirmed
	- control circuits	V	2000	Confirmed
2	**UAB / SSB / GIS- Potyard/SS/TRT/ Trf. Cavern Distribution Board**			
2.1	Rated current of busbar and board	A	UAB-1600A, SSB-5000A, Pot yard- 800A, Trf. Cavern-800A Surge Shaft- 400 A TRT-400 A Power House- 3150A Control block- 800A GIS-800 A	Confirmed
2.2	Material of bus bar	-	Copper	Confirmed
2.3	Protection class	-	IP42	Confirmed
3	**Circuit breaker (incoming circuit)**			
3.1	Rated current (at 40°C)	A	As per Drg NH/DEM/ URI I STG II /LT/01 and 02	Confirmed
3.2	Rated short circuit breaking current symmetrical	kArms	50	Confirmed
3.3	Rated short circuit making current	kApeak	To be decided during detailed engineering	Confirmed
3.4	Permissible short time current for 1 sec	kArms	50	Confirmed
3.5	Dynamic short time current	kApeak	To be decided during detailed engineering	Confirmed
4	**Moulded case circuit breaker (outgoing circuits)**			
4.1	Symmetrical short circuit breaking current	KArms	50	Confirmed
5	**Current transformers (incoming circuits)**			
5.1	Number of CT's		As per PTS cluase 19.5.7.1	Confirmed
5.2	Rated current primary / secondary side	A	As per PTS cluase 19.5.7.1	Confirmed

19 LV SWITCHGEAR AND AUXILIARY TRANSFORMERS

19.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
5.3	Accuracy class			
	-measuring cores	-	0.5S	Confirmed
	-protection cores	-	PS/5P20	Confirmed
5.4	Type / designation of meters	-	Digital	Confirmed
6	**Unit Auxiliary Transformers(UAT) (11 / 0.415kV) (Dry Type)**			
6.1	Transformer rated voltages at rated frequency and no-load			
	- high-voltage, principal tapping	kV	11	Confirmed
	- high-voltage, extreme plus tapping	kV	11.55	Confirmed
	- high-voltage extreme minus tapping	kV	10.45	Confirmed
6.2	Number of tap on HV-winding	Nos.	5	Confirmed
6.3	Short duration separate source power frequency withstand voltage, 1 minute			
	- HV winding	kVrms	28	Confirmed
	- LV winding	kVrms	3	Confirmed
6.4	Lightning impulse withstand voltage for HV winding	kVpeak	75	Confirmed
6.5	Transformer continuous three-phase power rating on any tapping	kVA	800	Confirmed
6.6	Maximum temperature rise in winding at rated power, frequency and on tap producing highest losses (measured by resistance)	^{o}C	100 ^{o}C over the ambient of 40 ^{o}C	Confirmed
6.7	Percentage impedance voltage at rated power, referred to 75°C and on principal tapping	%	5	Confirmed
6.8	Vector group	-	Dyn11	Confirmed
6.9	Type of cooling	-	AN	Confirmed
6.10	Class of insulation	-	H	Confirmed
6.11	Nominal currents at principal tapping			
	- HV winding	A	42	Confirmed
	- LV winding	A	1113	Confirmed
6.12	No- load current at rated voltage & frequency	A	1.5% (approx.) of rated current	Confirmed
7	**Station Service Transformers(SST) (11 / 0.415kV) (Dry Type)**			
7.1	Transformer rated voltages at rated frequency and no-load			
	- high-voltage, principal tapping	kV	11	Confirmed
	- high-voltage, extreme plus tapping	kV	11.55	Confirmed
	- high-voltage extreme minus tapping	kV	10.45	Confirmed

19 LV SWITCHGEAR AND AUXILIARY TRANSFORMERS

19.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
7.2	Number of tap on HV-winding	Nos.	5	Confirmed
7.3	Short duration separate source power frequency withstand voltage, 1 minute			
	- HV winding	kVrms	28	Confirmed
	- LV winding	kVrms	3	Confirmed
7.4	Lightning impulse withstand voltage for HV winding	kVpeak	75	Confirmed
7.5	Transformer continuous three-phase power rating on any tapping	kVA	2500	Confirmed
7.6	Maximum temperature rise in winding at rated power, frequency and on tap producing highest losses (measured by resistance)	^{o}C	100 ^{o}C over ambient of 40 ^{o}C	Confirmed
7.7	Percentage impedance voltage at rated power, referred to 75°C and on principal tapping	%	6	Confirmed
7.8	Vector group	-	Dyn11	Confirmed
7.9	Type of cooling	-	AN	Confirmed
7.10	Class of insulation	-	H	Confirmed
7.11	Nominal currents at principal tapping			
	- HV winding	A	131	Confirmed
	- LV winding	A	3478	Confirmed
7.12	No- load current at rated voltage & frequency	A	1.5% (approx.) of rated current	Confirmed
8	**Distribution Transformers (Dry Type) (11 / 0.415kV)**			
8.1	Transformer rated voltages at rated frequency and no-load			
	- high-voltage, principal tapping	kV	11	Confirmed
	- high-voltage, extreme plus tapping	kV	11.55	Confirmed
	- high-voltage extreme minus tapping	kV	10.45	Confirmed
8.2	Number of tap on HV-winding	Nos.	5	Confirmed
8.3	Short duration separate source power frequency withstand voltage, 1 minute			
	- HV winding	kVrms	28	Confirmed
	- LV winding	kVrms	3	Confirmed
8.4	Lightning impulse withstand voltage for HV winding	kVpeak	75	Confirmed
8.5	Transformer continuous three-phase power rating on any tapping	kVA	250	Confirmed

19 LV SWITCHGEAR AND AUXILIARY TRANSFORMERS

19.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
8.6	Maximum temperature rise in winding at rated power, frequency and on tap producing highest losses (measured by resistance)	°C	100 °C over ambient of 40 °C	Confirmed
8.7	Percentage impedance voltage at rated power, referred to 75°C and on principal tapping	%	4	Confirmed
8.8	Vector group	-	Dyn11	Confirmed
8.9	Type of cooling	-	AN	Confirmed
8.10	Class of insulation	-	F	Confirmed
8.11	Nominal currents at principal tapping			
	- HV winding	A	13.12	Confirmed
	- LV winding	A	347.81	Confirmed
8.12	No- load current at rated voltage & frequency	A	1.5% (approx.) of rated current	Confirmed
9	**Distribution Transformers (Dry Type) (11 / 0.415kV)**			
9.1	Transformer rated voltages at rated frequency and no-load			
	- high-voltage, principal tapping	kV	11	Confirmed
	- high-voltage, extreme plus tapping	kV	11.55	Confirmed
	- high-voltage extreme minus tapping	kV	10.45	Confirmed
9.2	Number of tap on HV-winding	Nos.	5	Confirmed
9.3	Short duration separate source power frequency withstand voltage, 1 minute			
	- HV winding	kVrms	28	Confirmed
	- LV winding	kVrms	3	Confirmed
9.4	Lightning impulse withstand voltage for HV winding	kVpeak	75	Confirmed
9.5	Transformer continuous three-phase power rating on any tapping	kVA	500	Confirmed
9.6	Maximum temperature rise in winding at rated power, frequency and on tap producing highest losses (measured by resistance)	°C	100 °C over ambient of 40 °C	Confirmed
9.7	Percentage impedance voltage at rated power, referred to 75°C and on principal tapping	%	4	Confirmed
9.8	Vector group	-	Dyn11	Confirmed
9.9	Type of cooling	-	ONAN	Confirmed
9.10	Class of insulation	-	F	Confirmed
9.11	Nominal currents at principal tapping			
	- HV winding	A	26.24	Confirmed

19 LV SWITCHGEAR AND AUXILIARY TRANSFORMERS

19.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
	- LV winding	A	695.62	Confirmed
9.12	No- load current at rated voltage & frequency	A	1.5% (approx.) of rated current	Confirmed

URI I STAGE II HYDROELECTRIC PROJECT

Volume III C (TDS)

20 ILLUMINATION SYSTEM

20.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	**Average Lux levels**			
1.1	**General areas**			
1.1.1	- Store	Lux	300	Confirmed
1.1.2	- Changing rooms, washrooms and toilets	Lux	200	Confirmed
1.1.3	- Staircases	Lux	200	Confirmed
1.1.4	-Galleries/walkways	Lux	100	Confirmed
1.1.5	MAT, Adits & other tunnels	Lux	50	Confirmed
1.2	**Office areas**			
1.2.1	- Control room	Lux	500	Confirmed
1.2.2	- Offices/Conference room	Lux	400	Confirmed
1.2.3	Reception lobby, model room	Lux	300	Confirmed
1.3	**Equipment areas**			
1.3.1	- Power house machine hall	Lux	300	Confirmed
1.3.2	- MIV floor, Turbine floor, generator floor	Lux	200	Confirmed
1.3.3	- Other floors & areas of power house & control block	Lux	200	Confirmed
1.3.4	-Turbine pit	Lux	200	Confirmed
1.3.5	-GIS cavern	Lux	300	Confirmed
1.3.7	-Transformer cavern	Lux	300	Confirmed
1.3.8	- Generator barrel	Lux	200	Confirmed
1.3.9	- Mechanical equipment areas	Lux	200	Confirmed
1.3.10	-High and low voltage switching installation in building	Lux	200	Confirmed
1.3.11	-Electrical & Mechanical workshop area	Lux	300	Confirmed
1.3.12	-DG Building	Lux	300	Confirmed
1.3.13	-Relay and telecommunication room	Lux	300	Confirmed
1.4	**Out door areas**			
1.4.2	- Outdoor area including U/G HSD Storage area, internal roads and fence area also	Lux	100	Confirmed
1.4.3	- Entrance, exit and other areas	Lux	100	Confirmed
1.4.4	-TRT outlet area	Lux	100	Confirmed
1.4.5	-Roads and Traffic areas	Lux	20	Confirmed
2	**Illumination panels**			
2.1	Minimum number of MLDB	Nos.	2	Confirmed
2.2	Minimum number of outgoing feeders	Nos.	20	Confirmed
3	Circuit breakers/fused load breaker switches			
3.1	Type	-	MCB	Confirmed
3.2	Service voltage	V	415V/ 240V	Confirmed
4	**Inverter**			
4.1	Type	-	On-line	Confirmed
4.2	Rating	-	During detail engineering	Confirmed
5	**Emergency lighting**			
5.1	DC based	-	Yes	Confirmed
5.2	AC based	-	Yes	Confirmed
6	Compliance of latest standards as per PTS clause no. 20.5.1	-	Yes	Confirmed
7	Emergency lighting lux level	Lux	min 20	Confirmed
8	Complete Compliance of Specification	-	Yes	Confirmed

21 COMMUNICATION SYSTEM

21.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement		Bidder's confirmation / seal / signature
A	**PUBLIC ADDRESS SYSTEM**				
1	Type	-	Digital		Confirmed
2	Echo interference	-	No		Confirmed
3	Integration with PLCC exchange	-	Yes		Confirmed
4	Master control station				
4.1	Mounting arrangement	-	Desktop Type		Confirmed
4.2	Dial pad	-	Yes		Confirmed
5	Central Switching system				
5.1	Communication	-	TDM/PCM		Confirmed
6	Central paging control and amplifier rack				
6.1	Mounting arrangement	-	Free Floor Standing		Confirmed
6.2	SNR	dB	60		Confirmed
7	Field handset station				
7.1	Number	no.	$\geq$ 40		Confirmed
7.2	Mounting arrangement	-	Wall/ column/ structure mounted		Confirmed
7.3	Microphone type	-	Dynamic noise cancelling type		Confirmed
8	Head Microphones				
8.1	Minimum number of head microphones	Nos.	2		Confirmed
9	**Loudspeakers (indoor)**				
9.1	Type	-	Cone	Horn	Confirmed
9.2	Sound level of loudspeakers	db(A)	$\pm$ 3	$\pm$ 3	Confirmed
9.3	Rated power (rms)	watts	4	15	Confirmed
9.4	Effective frequency range	Hz	100-7000	500-4500	Confirmed
9.5	Degree of protection	IP	IP 54		Confirmed
9.6	Minimum number of loudspeakers for indoor area	Nos.	$\geq$ 85		Confirmed
10	**Loudspeakers (outdoor)**				
10.1	Type	-	Horn		Confirmed
10.2	Sound level of loudspeakers	db(A)	$\pm$ 3		Confirmed
10.3	Rated power (rms)	watts	15		Confirmed
10.4	Effective frequency range	Hz	500-4500		Confirmed
10.5	Degree of protection	IP	IP 65		Confirmed
10.6	Minimum number of loudspeakers for outdoor area	Nos.	$\geq$ 45		Confirmed
11	Junction box				
11.1	Type	-	4 way		Confirmed
11.2	Degree of protection	-	IP 55(min)		Confirmed
B	**EPABX SYATEM**				

21 COMMUNICATION SYSTEM

21.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
	For Power House			
1	Eletromagnetic interference	-	No	Confirmed
2	EPABX System			
2.1	Type	-	Digital	Confirmed
2.2	Capacity of subscribers	Nos.	≥ 72 + future expandability 72 port	Confirmed
2.3	Capacity of trunk line	Nos.	≥ 8	Confirmed
2.4	Number of connections to parallel exchange	Nos.	≥ 8 (E&M ports)	Confirmed
2.5	Minimum number of telephone sets	Nos.	72	Confirmed
2.6	Type of telephone sets	-	Desktop	Confirmed
B	**CONFERENCE SYSTEM**			
1	Type	-	Digital	Confirmed
2	Integration with public address system	-	Yes	Confirmed
3	Audio conference system		As per PTS Clause no. 21.5.4.2	Confirmed
4	Video conference system		As per PTS Clause no. 21.5.4.3	Confirmed
C	Compliance of latest standards as per PTS clause no. 21.5.1	-	Yes	Confirmed
D	Compliance of latest specification		Yes	Confirmed

22 ELECTRICAL WORKSHOP

22.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	Complete compliance to PTS (Chapter - 22) with reputed International / National makes	-	Yes	Confirmed

23 ELECTRIC OVERHEAD TRAVELLING (EOT) CRANES

23.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
A.				
1	**Power House EOT crane**			
1.1	Type	-	Electrical Overhead Double Girder	Confirmed
1.2	Number of cranes	Nos.	2	Confirmed
1.3	Duty class of cranes	-	M3	Confirmed
1.4	Rated capacity of			
1.4.1	Main hoist	tonnes	150	Confirmed
1.4.2	Auxilliary hoist	tonnes	25	Confirmed
1.4.3	Monorail hoist	tonnes	15	Confirmed
1.5	Crane span (centre to centre of rails)	m	18.8 (approx.)	Confirmed
1.6	Runway length	m	140 (approx.)	Confirmed
1.7	Total lift (with load) of :			
1.7.1	Main hook	m	Not less than 27	Confirmed
1.7.2	Auxiliary hook	m	Not less than 43	Confirmed
1.7.3	Monorail hook	m	Not less than 43	Confirmed
1.8	Applicable Standards	-	IS:3177-1999, IS:807-1984	Confirmed
1.9	Adequacy of Crane capacity as 220Ton for lifting any heaviest/ biggest assembly of Turbine/ Generator	-	Yes	Confirmed
1.10	Factor of safety for			
	- Crane structure	-	As per IS 3177	Confirmed
	- wire rope	-	Not less than 6	Confirmed
	- Crane mechanism	-	As per IS 3177	Confirmed
	- Rope drum	-	Not less than 5	Confirmed
1.11	Maximum operating speeds (at rated load)			
1.11.1	bridge travel (long)	m/min.	Not more than 25	Confirmed
1.11.2	trolley travel (cross)	m/min.	Not more than 15	Confirmed
1.11.3	Main hoist lift / lower	m/min.	Not more than 1.2	Confirmed
1.11.4	Auxiliary hoist lift / lower	m/min.	Not more than 8	Confirmed
1.11.5	Monorail Hoist lift/lower	m/min.	Not more than 8	Confirmed

23 ELECTRIC OVERHEAD TRAVELLING (EOT) CRANES

23.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
1.12	Acceleration / deceleration			
1.12.1	bridge travel	m/sec^2	0.10	Confirmed
1.12.2	trolley travel	m/sec^2	0.08	Confirmed
1.13	Maximum vertical deflection of bridge girder at rated load including dead load	mm	Span/1000	Confirmed
1.14	Speed Regulation	-	5% to 100%	Confirmed
1.14.1	Steps of controller	-	Not less than 6	Confirmed
1.15	Minimum Incremental Movement of			
1.15.1	Main hoist	mm	Not more than 1.5	Confirmed
1.15.2	Auxiliary hoist	mm	Not more than 1.5	Confirmed
1.15.3	Bridge Travel	mm	Not more than 3	Confirmed
1.15.4	Trolley Travel	mm	Not more than 3	Confirmed
1.15.5	Monorail travel	mm	Not more than 5	Confirmed
1.16	Crane motors			
1.16.1	Drive	-	VVVF	Confirmed
1.16.2	Insulation class and protection class	-	F, IP55	Confirmed
1.16.3	Duty factor of motor for normal speed	-	40%	Confirmed
1.17	Maximum distance between bottom of gantry rail and the highest point of the crane	mm	Not more than 5000	Confirmed
1.18	Terminal position of			
1.18.1	Main hook from centre of gantry rail on			
	- Upstream side	mm	1900	Confirmed
	- Downstream side	mm	2300	Confirmed
1.18.2	Auxiliary hook from centre of gantry rail on			
	- Upstream side	mm	2500	Confirmed
	- Downstream side	mm	1500	Confirmed
1.18.3	Monorail hook from centre of gantry rail on			
	- Upstream side	mm	2000	Confirmed
	- Downstream side	mm	2000	Confirmed
1.18.4	Main hook from inner edge of wall at			
	- service bay wall	mm	3500	Confirmed
	- other end	mm	3500	Confirmed
1.18.5	Auxiliary hook from inner edge of wall at			
	- service bay wall	mm	3500	Confirmed
	- other end	mm	3500	Confirmed
1.19	Type of brakes for			
1.19.1	LT travel	-	DCEM + EHT	Confirmed

23 ELECTRIC OVERHEAD TRAVELLING (EOT) CRANES

23.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
1.19.2	CT travel	-	DCEM + EHT	Confirmed
1.19.3	Main hoist	-	DCEM + EHT	Confirmed
1.19.4	Auxilary hoist	-	DCEM + EHT	Confirmed
1.19.5	Mono-rail hoist	-	EHT	Confirmed
1.19.6	Monorail cross travel	-	AC/DC EM	Confirmed
1.20	EOT crane(s) to be handed over with last generating unit & maintained by Contractor	-	Yes	Confirmed
1.21	EOT crane(s) to be operated with power cables till DSL is in place and charged	-	Yes	Confirmed
1.22	DSL conductor material	-	Copper	Confirmed
2	**GIS Building EOT crane**			
2.1	Type	-	Electrical Overhead single Girder	Confirmed
2.2	Number of cranes	Nos.	1	Confirmed
2.3	Duty class of cranes	-	M3	Confirmed
2.4	Rated capacity of hoist	tonnes	5	Confirmed
2.5	Crane span (centre to centre of rails)	m	15.75 (approx.)	Confirmed
2.6	Runway length	m	105 (approx.)	Confirmed
2.7	Total lift of hook	m	Not less than 21 m (approx.)	Confirmed
2.8	Operating speed for hook lift / lower	m/min.	1.2	Confirmed
2.9	Maximum vertical deflection of bridge girder at rated load including dead load	mm	Span/1000	Confirmed
2.1	Speed Regulation	-	5% to 100%	Confirmed
2.11	Crane motors			
2.11.1	Drive	-	VVVF	Confirmed
2.11.2	Insulation class and protection class	-	F, IP55	Confirmed
2.11.3	Relative duty factor of motor for normal speed	-	40%	Confirmed
2.12	Type of brakes for	-		
2.12.1	LT travel	-	DCEM + EHT	Confirmed
2.12.2	CT travel	-	DCEM + EHT	Confirmed
2.12.3	Main hoist	-	DCEM + EHT	Confirmed
2.13	DSL conductor material	-	Copper	Confirmed

24 COOLING WATER SYSTEM

24.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
A	**Primary cooling water circuit**			
1	**Primary cooling water pumps**			
1.1	Type	-	Horizontal centrifugal	Confirmed
1.2	Pumping capacity at maximum continuous rating (MCR)	lpm	As per the requirement and approval during detailed engineering	Confirmed
1.3	Total Number of pumps	Nos.	As per PTS clause no.24.1.1	Confirmed
1.4	Duty of pumps	-	Continuous	Confirmed
1.5	Insulation class of pump-motors	-	F (temperature rise limited to B)	Confirmed
2	**Automatic Back wash Duplex stainer**			
2.1	Type	-	Wedge wire type	Confirmed
2.2	Total number	Nos.	As per PTS clause no.24.1.1	Confirmed
2.3	Design head	m	As per the requirement and approval during detailed engineering	Confirmed
2.4	Water flow rate at design head and at maximum continuous rating	Lpm	As per the requirement and approval during detailed engineering	Confirmed
2.5	Cleaning effectiveness, particulate matter down to	microns	1000	Confirmed
3	**Automatic self cleaning filter**			
3.1	Type	-	Wedge wire type	Confirmed
3.2	Total number	Nos.	As per PTS clause no.24.1.1	Confirmed
3.3	Design head	m	As per the requirement and approval during detailed engineering	Confirmed

24 COOLING WATER SYSTEM

24.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
3.4	Water flow rate at design head and at maximum continuous rating	Lpm	As per the requirement and approval during detailed engineering	Confirmed
3.5	Cleaning effectiveness, particulate matter down to	microns	600	Confirmed
4	**Plate type heat exchanger**			
4.1	Type	-	Wide gap plate type	Confirmed
4.2	Total number	nos.	as per PTS clause no.24.1.1	Confirmed
4.3	Primary system water temperature			Confirmed
4.4	-inlet(maximum)	°C	22	Confirmed
4.5	-outlet (maximum)	°C	27	Confirmed
4.6	Secondary system water temperature			Confirmed
4.7	-inlet (maximum)	°C	As per the requirement and approval during detailed engineering	Confirmed
4.8	-outlet (maximum)	°C		Confirmed
4.9	Minimum thickness of plate	mm	0.8	Confirmed
B	**Secondary cooling water circuit**			
1	**Secondary cooling water pumps**			
1.1	Type	-	Horizontal centrifugal	Confirmed
1.2	Pumping capacity at maximum continuous rating (MCR)	lpm	As per the requirement and approval during detailed engineering	Confirmed
1.3	Number of pumps	Nos.	as per PTS clause no.24.1.1	Confirmed
1.4	Duty of pumps	-	Continuous	Confirmed
1.5	Insulation class of pump-motors	-	F	Confirmed
2	**Automatic self cleaning filter**			
2.1	Type	-	Wedge wire type	Confirmed
2.2	Total number	Nos.	As per PTS clause no.24.1.1	Confirmed
2.3	Design head	m	As per the requirement and approval during detailed engineering	Confirmed

24 COOLING WATER SYSTEM

24.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
2.4	Water flow rate at design head and at maximum continuous rating	lpm	As per the requirement and approval during detailed engineering	Confirmed
2.5	Cleaning effectiveness, particulate matter down to	microns	Upto 100	Confirmed
C	**Shaft seal clean water & make up water supply circuit**			
1	**Shaft sealing cooling water/make up water pumps**			
1.1	Type	-	Horizontal centrifugal	Confirmed
1.2	Pumping capacity at maximum continuous rating (MCR)	lpm	As per the requirement and approval during detailed engineering	Confirmed
1.3	Number of pumps	Nos.	as per PTS clause no.24.1.1	Confirmed
1.4	Duty of pumps	-	Continuous	Confirmed
1.5	Insulation class of pump-motors	-	F	Confirmed
2	**Automatic self cleaning filter**			Confirmed
2.1	Type	-	Wedge wire type	Confirmed
2.2	Total number	Nos.	as per PTS clause no.24.1.1	Confirmed
2.3	Cleaning effectiveness, particulate matter down to	microns	Upto 600	Confirmed
3	**Cyclone separators**			Confirmed
3.1	Type	-	Centrifugal type with automatic purging (75)	Confirmed
3.2	Total number	Nos.	As per PTS clause no.24.1.1	Confirmed
3.3	Design head	m	As per the requirement and approval during detailed engineering	Confirmed

24 COOLING WATER SYSTEM

24.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
3.4	Water flow rate at design head	lpm	As per the requirement and approval during detailed engineering	Confirmed
3.5	Cleaning effectiveness, particulate matter down to	microns	Upto 75	Confirmed
3.6	Filter cleaning effectiveness for the above	%	98	Confirmed
3.7	Whether bolting type lower and upper half of casing is provided	-	Yes	Confirmed
3.8	Whether neoprene rubber liner for purge valve provided	-	Yes	Confirmed
4	**Dual skid mounted self flushing candle type filters**			Confirmed
4.1	Type	-	Wedge wire type	Confirmed
4.2	Total number	Nos.	as per PTS clause no.24.1.1	Confirmed
4.3	Cleaning effectiveness, particulate matter down to	microns	50 micron or better	Confirmed
5	**Secondary system make up water tank for cooling**			Confirmed
5.1	Total numbers	nos.	1	Confirmed
5.2	Tank Capacity	litre	As per the requirement and approval during detailed engineering	Confirmed
5.3	Testing instrument for quality check of make-up water in the circuit	-	Yes	Confirmed
B	**Shaft seal clean water supply circuit**			Confirmed
1	**Automatic self-Cleaning filter**			Confirmed
1.1	Type	-	Wedge wire type	Confirmed
1.2	Total number	Nos.	As per PTS clause no.24.1.1	Confirmed
1.3	Design head	m	As per the requirement and approval during detailed engineering	Confirmed

24 COOLING WATER SYSTEM

24.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
1.4	Water flow rate at design head and at maximum continuous rating	Lpm	As per the requirement and approval during detailed engineering	Confirmed
1.5	Cleaning effectiveness, particulate matter down to	micron	50 and above	Confirmed
C	**Material/ standard/ class/ grade/ type for**			Confirmed
1	Cooling water pumps			
1.1	Pump casing	-	Cast steel/grey cast iron	Confirmed
1.2	Pump impeller	-	stainless steel (AISI 316 or better)	Confirmed
2	**Automatic Back wash Duplex strainer**			Confirmed
2.1	Filter element/ candle	-	Stainless steel	Confirmed
2.2	Housing	-	Cast steel	Confirmed
3	**Automatic Self-cleaning strainer**			Confirmed
3.1	Filter element/ candle	-	Stainless steel	Confirmed
3.2	Housing	-	Cast steel	Confirmed
4	**Cyclone seperator housing**	-	Stainless steel (316 or better)	Confirmed
D	Cooling water system (open loop), shaft seal system, etc. should be capable of continuous working satisfatorly for upto & including (detailed as per enclosure-1) silt level	-	Yes	Confirmed
E	Compliance of latest standards as per PTS clause no. 24.5.1	-	Yes	Confirmed
F	Complete Compliance of Specification	-	Yes	Confirmed

25 DRAINAGE AND DEWATERING SYSTEM

25.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
1	**Power house drainage pumps**			
1.1	Type	-	Submersible	Confirmed
1.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
1.3	Unit discharge at rated head	Lpm	Higher of (6000 / discharge calculated)	Confirmed
	Rated head of the pump	m	As per head calculation	Confirmed
1.4	Duty of pump-motors	-	Continuous	Confirmed
1.5	Duty of pump-motors	-	H / F	Confirmed
1.6	Insulation class of pump-motors	-	IP 68	Confirmed
1.7	Motor service factor	-	Min. 1.1	Confirmed
1.8	Speed of pump	rpm	1450 / 1500	Confirmed
2	**Power house flood dewatering pump**			
2.1	Type	-	Submersible	Confirmed
2.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
2.3	Unit discharge at rated head	Lpm	Higher of (6000 / discharge calculated)	Confirmed
2.4	Rated head of the pump	m	As per head calculation	Confirmed
2.5	Duty of pump-motors	-	Continuous	Confirmed
2.6	Insulation class of pump-motors	-	H / F	Confirmed
2.7	Protection class of pump-motors	-	IP 68	Confirmed
2.8	Motor service factor		Min. 1.1	Confirmed
2.9	Speed of pump	rpm	1450 / 1500	Confirmed
2.10	All piping, power cables, NRVs, etc included in line with PTS cl. no.25.2.1.6 & 25.5.3	-	Yes	Confirmed
3	**Power house dewatering pump**			
3.1	Type	-	Submersible	Confirmed
3.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
3.3	Unit discharge at rated head	Lpm	Higher of (6000 / discharge calculated)	Confirmed
	Rated head of the pump	m	As per head calculation	Confirmed
3.4	Duty of pump-motors	-	Continuous	Confirmed

25 DRAINAGE AND DEWATERING SYSTEM

25.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
3.5	Insulation class of pump-motors	-	H / F	Confirmed
3.6	Protection class of pump-motors	IP	IP 68	Confirmed
3.7	Motor service factor		Min. 1.1	Confirmed
3.8	Speed of pump	rpm	1450 / 1500	Confirmed
4	**Oil- water sump pumps in transformer cavern**			
4.1	Type	-	Submersible	Confirmed
4.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
4.3	Unit discharge at rated head	Lpm	Higher of (3000 / discharge calculated)	Confirmed
4.4	Rated head of the pump	m	As per head calculation	Confirmed
4.5	Duty of pump-motors	-	Continuous	Confirmed
4.6	Insulation class of pump-motors	-	H / F	Confirmed
4.7	Protection class of pump-motors	-	IP 68	Confirmed
4.8	Motor service factor	-	Min. 1.1	Confirmed
4.9	Speed of pump	rpm	1450 / 1500	Confirmed
5	**Transformer Cum GIS Cavern Drainage pump**			
5.1	Type	-	Submersible	Confirmed
5.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
5.3	Unit discharge at rated head	Lpm	Higher of (4000 / discharge calculated)	Confirmed
5.4	Rated head of the pump	m	As per head calculation	Confirmed
5.5	Duty of pump-motors	-	Continuous	Confirmed
5.6	Insulation class of pump-motors	-	H / F	Confirmed
5.7	Protection class of pump-motors	-	IP 68	Confirmed
5.8	Motor service factor	-	Min. 1.1	Confirmed
5.9	Speed of pump	rpm	1450 / 1500	Confirmed
6	**Drainage pumps for MAT cum Access Tunnel to Transformer Cavern**			
6.1	Type	-	Submersible	Confirmed
6.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
6.3	Unit discharge at rated head	Lpm	Higher of (4000 / discharge calculated)	Confirmed

25 DRAINAGE AND DEWATERING SYSTEM

25.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
6.4	Rated head of the pump	m	As per head calculation	Confirmed
6.5	Duty of pump-motors	-	Continuous	Confirmed
6.6	Insulation class of pump-motors	-	H / F	Confirmed
6.7	Protection class of pump-motors	IP	68	Confirmed
6.8	Motor service factor	-	Min. 1.1	Confirmed
6.9	Speed of pump	rpm	1450 / 1500	Confirmed
7	**Drainage pumps for MAT**			
7.1	Type	-	Submersible	Confirmed
7.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
7.3	Unit discharge at rated head	Lpm	Higher of (6000 / discharge calculated)	Confirmed
7.4	Rated head of the pump	m	As per head calculation	Confirmed
7.5	Duty of pump-motors	-	Continuous	Confirmed
7.6	Insulation class of pump-motors	-	H / F	Confirmed
7.7	Protection class of pump-motors	IP	68	Confirmed
7.8	Motor service factor	-	Min. 1.1	Confirmed
7.9	Speed of pump	rpm	1450 / 1500	Confirmed
8	**Drainage pumps for MAT and Adit to PH crown**			
8.1	Type	-	Submersible	Confirmed
8.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
8.3	Unit discharge at rated head	Lpm	Higher of (3000 / discharge calculated)	Confirmed
8.4	Rated head of the pump	m	As per head calculation	Confirmed
8.5	Duty of pump-motors	-	Continuous	Confirmed
8.6	Insulation class of pump-motors	-	H / F	Confirmed
8.7	Protection class of pump-motors	IP	68	Confirmed
8.8	Motor service factor	-	Min. 1.1	Confirmed
8.9	Speed of pump	rpm	1450 / 1500	Confirmed

25 DRAINAGE AND DEWATERING SYSTEM

25.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
9	**Drainage pumps for control block cavern**			
9.1	Type	-	Submersible	Confirmed
9.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
9.3	Unit discharge at rated head	Lpm	Higher of (3000 / discharge calculated)	Confirmed
9.4	Rated head of the pump	m	As per head calculation	Confirmed
9.5	Duty of pump-motors	-	Continuous	Confirmed
9.6	Insulation class of pump-motors	-	H / F	Confirmed
9.7	Protection class of pump-motors	IP	68	Confirmed
9.8	Motor service factor	-	Min. 1.1	Confirmed
9.9	Speed of pump	rpm	1450 / 1500	Confirmed
10	**Drainage pumps for Adit to Lower Penstock Erection Gallery**			
10.1	Type	-	Submersible	Confirmed
10.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
10.3	Unit discharge at rated head	Lpm	Higher of (3000 / discharge calculated)	Confirmed
10.4	Rated head of the pump	m	As per head calculation	Confirmed
10.5	Duty of pump-motors	-	Continuous	Confirmed
10.6	Insulation class of pump-motors	-	H / F	Confirmed
10.7	Protection class of pump-motors	IP	68	Confirmed
10.8	Motor service factor	-	Min. 1.1	Confirmed
10.9	Speed of pump	rpm	1450 / 1500	Confirmed
11	**Submersible slurry pump for Power house drainage**			
11.1	Type	-	Submersible	Confirmed
11.2	Number of pumps	Nos.	As per PTS cluase no.25.1.1	Confirmed
11.3	Unit discharge at rated head	Lpm	Higher of (3000 / discharge calculated)	Confirmed
11.4	Rated head of the pump	m	As per head calculation	Confirmed
11.5	Duty of pump-motors	-	Continuous	Confirmed
11.6	Insulation class of pump-motors	-	H / F	Confirmed
11.7	Protection class of pump-motors	IP	68	Confirmed

25 DRAINAGE AND DEWATERING SYSTEM

25.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
11.8	Motor service factor	-	Min. 1.1	Confirmed
11.9	Speed of pump	rpm	1450 / 1500	Confirmed
11	**Material/ Standard/Class/Grade/ Type for**			
11.1	Pumps			
	- Pump and motor shaft	-	Stainless steel (AISI 410 or better)	Confirmed
	- Pump impeller	-	stainless steel (AISI 316 or better)	Confirmed
	- Chain , guide rail, guide support	-	Stainless steel	Confirmed
11.2	Piping			
	- Embedded piping	-	As per PTS cluase no.25.5.3	Confirmed
	- Exposed piping	-		Confirmed
12	Electromagnetic with digital display flow meter for individual pumps & common header included	-	Yes	Confirmed
13	Provisions as mentioned at PTS clause no. 25.5.3 like NRV, isolating valves, etc. are included	-	Yes	Confirmed
14	Compliance of latest standards as per PTS clause no. 25.5.1	-	Yes	Confirmed
15	Complete Compliance of Specification	-	Yes	Confirmed

26 HEATING VENTILATION AND AIR CONDITIONING (HVAC) SYSTEM

26.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Requirement	Bidder's confirmation /seal / signature
1	**General**			
1.1	Type		Floor Mounted	Confirmed
2	**Air handling units (AHU)**			
2.1	Type		Double skinned	Confirmed
2.2	Cooling coil efficiency	%	minimum 90	Confirmed
2.3	Heating coil efficiency	%	minimum 85	Confirmed
2.4	Noise level	dB(A)	As per PTS Clause 26.3.4	Confirmed
2.5	Minimum air flow rate			
2.5.1	- AHU # 2a,2b& 3a,3b	CMH	To be decided during detailed engineering	Confirmed
2.6	Proportion of fresh air to recirculated air			Confirmed
2.6.1	- AHU # 2a,2b& 3a,3b	CMH	To be decided during detailed engineering	Confirmed
2.7	Maximum delivery head pressure(acc to system pressure drop)	Pa	To be decided during detailed engineering	Confirmed
2.8	Type of unit (Single / double skin)		Double skin	Confirmed
2.9	Fan section			
2.9.1	- Type		Backward Curved	Confirmed
2.9.2	- Number of fan & class of rating	Nos.	To be decided during detailed engineering	Confirmed
2.9.3	- Drive arrangement		V-belt	Confirmed
2.9.4	- Total air quantity	CMH	To be decided during detailed engineering	Confirmed
2.9.5	- Whether statically and dynamically balanced		Yes	Confirmed
3	**Water cooled packaged Air Conditioning unit 4a, 4b, 4c**			
3.1	Capacity of fully assembled units ; (2Working +1 Standby)	TR	To be decided during detailed engineering	Confirmed
3.2	Type		Water cooled ducted split type enclosed in a cabinet housing	Confirmed

26 HEATING VENTILATION AND AIR CONDITIONING (HVAC) SYSTEM

26.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Requirement	Bidder's confirmation /seal / signature
3.3	Refrigerant used		ozone friendly refrigerant (R-134a) or better	Confirmed
3.4	Overall size of each unit LxDxH		To be decided during detailed engineering	Confirmed
3.5	Noise level	dB(A)/ m	As per PTS Clause 26.3.4	Confirmed
3.6	Total input power at design condition	KW	To be decided during detailed engineering	Confirmed
3.7	**Compressor**			
3.7.1	- Type		Hermetic direct driven scroll/reciprocating	Confirmed
3.7.2	- Suction temperature	^{o}C	To be decided during detailed engineering	Confirmed
3.7.3	- Suction pressure	Kg/cm^2	To be decided during detailed engineering	Confirmed
3.7.4	-Insulation Class		Class F insulation (temperature rise limited to class B),	Confirmed
3.7.5	- Duty class of the motor		Continuous	Confirmed
3.7.6	- Type of start		DOL	Confirmed
3.8	Cooling coil			
3.8.1	- Type		Flooded type with copper tubes and aluminium fins	Confirmed
3.8.2	- Sensible & Latent cooling capacity at design conditions	Kcal/hr	To be decided during detailed engineering	Confirmed
3.8.3	- Face Area	m^2	To be decided during detailed engineering	Confirmed
3.8.4	- Air face velocity	m/sec	To be decided during detailed engineering	Confirmed
3.8.5	- Air side pressure drop	mm WC	To be decided during detailed engineering	Confirmed
3.9	Condensor			

26 HEATING VENTILATION AND AIR CONDITIONING (HVAC) SYSTEM

26.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Requirement	Bidder's confirmation /seal / signature
3.9.1	- Type		Water cooled condenser	Confirmed
3.9.2	- Heat rejection capacity at design condition		To be decided during detailed engineering	Confirmed
3.9.3	- cooling water flow rate		To be decided during detailed engineering	Confirmed
3.9.4	- cooling water inlet temperature		max 30 0C	Confirmed
3.9.5	- cooling water outlet temperature		To be decided during detailed engineering	Confirmed
4	**Air ducts**			
4.1	Maximum air velocities in ducts			Confirmed
4.2	In main ducts	m/ sec	as per PTS clause no.26.3.5	Confirmed
4.3	In branch ducts	m/ sec		Confirmed
4.4	In occupied room zones	m/ sec		Confirmed
4.5	Noise level of fans	dB(A)/ m	As per PTS Clause 26.3.4	Confirmed
4.6	Duct insulation thickness for supply, return and fresh air duct	mm	To be decided during detailed engineering	Confirmed
5	**AHU Fan Motors**			
5.1	Motor Speed	rpm	1450/1500	Confirmed
6	**Air Filters**			
6.1	Type		V-fold HDPE(High density Polythylene) supported by Aluminium wire mesh with water as the mode of cleaning medium	Confirmed
6.2	Rated flow	m^3/min	55	Confirmed

26 HEATING VENTILATION AND AIR CONDITIONING (HVAC) SYSTEM

26.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Requirement	Bidder's confirmation /seal / signature
6.3	Face velocity	m/min	150	Confirmed
7	**Humidification Package**			
7.1	Type/ designation		Pan type	Confirmed
8	**Exaust Fans**			
8.1	Type		Adjustable axial flow fans	Confirmed
8.2	Number of fans, blades/vanes of each type	Nos.	Total nos. to be decided during detailed engineering	Confirmed
8.3	Air quantity of each type of fans	m^3/min	To be decided during detailed engineering	Confirmed
8.4	Noise Level	dB(A)	As per PTS Clause 26.3.4	Confirmed
9	**Air conditioner for Potyard office**			
9.1	Type		Split type	Confirmed
9.2	No. of units	Nos.	As per PTS Clause 26.1.2	Confirmed
9.3	Each Capacity	TR	To be decided during detailed engineering	Confirmed
9.4	Noise level	dB(A)/ m	As per PTS Clause 26.3.4	Confirmed
10	**Fire/Smoke Dampers**			
10.1	Type		Multi blade motorised operated type	Confirmed
11	**Electrical Controls**			
11.1	Type		Fully automatic mode and manual mode	Confirmed
11.2	Three way mixing valve for AHUs		Yes	Confirmed
11.3	Motorise valve for fan cooling unit and water cooled pacakged AC		Yes	Confirmed
11.4	Thermostat for AHU and FCU, ACU		Yes	Confirmed
11.5	Automatic control for dampers		Yes	Confirmed
12	**Cooling water circuit**			
12.1	**Open loop raw water cooling water pump**			
12.1.1	-Type		Horizontal centrifugal	Confirmed

26 HEATING VENTILATION AND AIR CONDITIONING (HVAC) SYSTEM

26.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Requirement	Bidder's confirmation /seal / signature
12.1.2	-Number of pumps	Nos.	As per PTS Clause 26.1.3	Confirmed
12.1.3	-Pumping capacity	Lpm	To be decided during detailed engineering	Confirmed
12.2	**Raw water Automatic self cleaning filter**			
12.2.1	Type	-	Wedge wire candle type	Confirmed
12.2.2	Total number	Nos.	As per PTS clause no.26.1.3	Confirmed
12.2.3	Cleaning effectiveness, particulate matter down to	microns	1000 microns in primary filter	Confirmed
12.3	**Cyclone separators**			Confirmed
12.3.1	Total number	Nos.	As per PTS Clause 26.1.3	Confirmed
12.3.2	Cleaning effectiveness, particulate matter down to	microns	upto 70	Confirmed
12.3.3	Filter cleaning effectiveness for the above	%	98	Confirmed
12.3.4	Whether bolting type lower and upper half of casing is provided		Yes	Confirmed

27 GROUNDING SYSTEM

27.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	Expected total earthing impedance of earthing system	ohm	less than 0.5	Confirmed
2	Design short-circuit and ground fault currents, 1 s			
2.1	400 KV System	kA_{rms}	63 kA	Confirmed
2.2	Fault clearing time	sec	1	Confirmed
2.3	Type and Material of earthing conductors			
	- Buried in ground	-	MS rod / Flat	Confirmed
	- Embedded in concrete	-	MS rod / Flat	Confirmed
	Above ground/ Above floor	-	Galvanised Iron Flat	Confirmed
3	Electronic earthing to be done(if required)	-	Yes	Confirmed
4	Two separate electrodes for each generator,reactor & transformer neutrals	-	as per Clause 27.5.5	Confirmed
5	Earthing pit as required	-	Yes	Confirmed
6	Bentonite clay if required	-	Yes	Confirmed
7	Method of interconnection of grids	-	Bolted	Confirmed
8	Method of connection of conductor laid in ground	-	Grid net & thermo welded	Confirmed
9	Length of overlap for lap joint	-	Double the width of flat	Confirmed
10	Compliance of latest standards as per PTS clause no. 27.5.1	-	Yes	Confirmed
11	Complete compliance of Specification	-	Yes	Confirmed

28 COMPRESSED AIR SYSTEMS

28.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	**LP Compressor unit**			
1.1	**LP Compressors**			
1.1.1	- Type	-	Rotary screw type (Oil flooded type)	Confirmed
1.1.2	- Number of units	Nos.	As per PTS clause no.28.1.1	Confirmed
1.1.3	- Nominal discharge pressure	bars	7	Confirmed
1.1.4	- Unit discharge rate	m^3/h	As per the requirement and approval during detailed engineering	Confirmed
1.1.5	- Free air Delivery (FAD)	m^3/h	min 180m^3/h or higher as per the requirement and approval during detailed engineering	Confirmed
1.1.6	- Max. pressure for operation of safety device	Kg/cm^2	As per the requirement and approval during detailed engineering	Confirmed
1.1.7	- Duty of the compressor motor	-	continuous duty	Confirmed
1.1.8	- Insulation and protection class of the motor	-	Class-F with temperature rise limited to class B, IP54	Confirmed
1.2	**LP air receivers**			Confirmed
1.2.1	- Number of receivers	Nos.	As per PTS clause no.28.1.1	Confirmed
1.2.2	- Volume per receiver	m^3	As per the requirement and approval during detailed engineering	Confirmed
1.3	**LP air dryer**			
1.3.1	-Type	-	Regenerative type	Confirmed

28 COMPRESSED AIR SYSTEMS

28.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1.3.2	- Number of dryers	Nos.	As per PTS clause no.28.1.1	Confirmed
1.3.3	- Unit discharge rate	m^3/h	As per the requirement and approval during detailed engineering	Confirmed
2	**Blowdown Compressor Units (Synchronous condenser operation)**			
2.1	**Compressors**			
2.1.1	- Number of units	Nos.	As per PTS clause no.28.1.1	Confirmed
2.1.2	- Nominal discharge pressure	-	Compliance to clause no. 28.2.4 of PTS	Confirmed
2.1.3	- Unit discharge rate	-	Compliance to clause no. 28.2.4 of PTS	Confirmed
2.1.4	- Free air Delivery (FAD)	-	Compliance to clause no. 28.2.4 of PTS	Confirmed
2.1.5	- Max. pressure for operation of safety device	-	Compliance to clause no. 28.2.4 of PTS	Confirmed
2.1.6	- Insulation and protection class of the motor	-	Class-F with temperature rise limited to class B, IP54	Confirmed
2.2	**Air receivers**			
2.2.1	- Number of receivers	Nos.	As per PTS clause no.28.1.1	Confirmed
2.2.2	- Volume per receiver	m^3	As per the requirement and approval during detailed engineering	Confirmed
3	Compliance of latest standards as per PTS clause no. 28.5.1	-	Yes	Confirmed
4	Complete Compliance of Specification	-	Yes	Confirmed

29 FIRE FIGHTING SYSTEM

29.1.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	**Fire pumps**			
1.1	Type	-	Horizontal centrifugal	
1.2	Total number	Nos.	As per PTS clause no.29.1.1 (i)	
1.3	Duty of pump-motors	-	Continuous	
1.4	Designed for 150% of required capacity in LPM	-	Yes	
1.5	Insulation class of pump-motors	-	Class F insulation (temperature rise limited to class B)	
2	**Bore well Pumps**			
2.1	Type	-	Vertical shaft type centrifugal	
2.2	Total number	Nos.	As per PTS clause no.29.1.1 (iii)	
3	**Number of automatic controlled Deluge valves for**			
3.1	Generator	Nos.	As per the requirement and approval during detailed engineering	
3.2	Generator transformers	Nos.	As per the requirement and approval during detailed engineering	
3.3	Turbine oil pumping units	Nos.	As per the requirement and approval during detailed engineering	
3.4	Main inlet valve pumping units	Nos.	As per the requirement and approval during detailed engineering	
3.5	Bus reactors	Nos.	As per the requirement and approval during detailed engineering	
3.7	Number of wet sprinkler valves	Nos.	As per the requirement and approval during detailed engineering	
4	**Fire detection and alarm system**			
4.1	Total number of detector lines	Nos.	As per the requirement and approval during detailed engineering	
4.2	Main fire alarm panel			

29 FIRE FIGHTING SYSTEM

29.1.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
4.2.1	- Number of main panels	Nos.	as per PTS clause no.29.1.3	
4.2.2	- Type/designation	-	Microprocessor based addressable intelligent type	
4.2.3	- Minimum no. of loops	Nos.	5 (min)	
4.3	Repeater panels			
	-Nos. of repeater panels	Nos.	as per PTS clause no.29.1.3	
5	**Material/ Standard/Class/Grade/ Type for**			
5.1	Strainers candle /element	-	Stainless steel	
5.2	Spray nozzles	-	SS-304	
5.3	Pump impellers	-	stainless steel (AISI 316 or better)	
5.4	Pump shafts	-	Stainless steel (AISI 410 or better)	
5.5	Pump casings	-	Cast steel (ASTM A 216 WCB or better)	
6	**Automatic self-cleaning Duplex filter**			
6.1	Type	-	Wedge wire type	
6.2	Total number	Nos.	As per PTS clause no.29.1.1	
6.3	Design head	m	As per the requirement and approval during detailed engineering	
6.4	Water flow rate at design head and at maximum continuous rating	Lpm	As per the requirement and approval during detailed engineering	
6.5	Cleaning effectiveness, particulate matter down to	micron	600	
7	**Cyclone separator**			
7.1	Type	-	Centrifugal type with automatic purging upto 74 micron	
7.2	Total number	Nos.	As per PTS clause no.29.1.1	

29 FIRE FIGHTING SYSTEM

29.1.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
7.3	Design head	m	As per the requirement and approval during detailed engineering	
7.4	Water flow rate at design head	lpm	As per the requirement and approval during detailed engineering	
7.5	Cleaning effectiveness, particulate matter down to	microns	74	
7.6	Filter cleaning effectiveness for the above	%	98	
7.7	Whether bolting type lower and upper half of casing is provided	-	Yes	
7.8	Whether neoprene rubber liner for purge valve provided	-	Yes	
8	Applicable standards as per PTS clause no. 29.5.1	-	Yes	
9	Complete compliance to Cl. No. 29.2.1	-	Yes	
10	Complete compliance to Cl. No. 29.5.7	-	Yes	
11	Compatibility of fire protection system with station SCADA	-	Yes	
12	Complete compliance to cl. No. 29.5.9	-	Yes	
13	Confirmation for separate inlet (filling) and outlet pipeline from water tank	-	Yes	
14	Compliance of latest standards as per PTS clause no. 29.5.1	-	Yes	
15	Complete Compliance of Specification	-	Yes	

30 OIL HANDLING SYSYTEM

30.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
1	**Insulating oil system**			
1.1	Tyre mounted large plant	-		
1.2	- Type	-	Vaccum type	
1.3	- Number supplied	Nos.	as per PTS clause no.30.1.1	
1.4	- Rate of oil flow	LPH	6000	
2.2	Capabilty of insulating oil purifying plant both small and large, after single pass			
2.2.1	Moisture content	PPM	<5	
2.2.2	Filtration	micron	<1	
2.3	Tyre mounted large insulating oil tanks			
2.3.1	- Number	Nos.	As per PTS clause no.30.1.1	
2.3.2	- Capacity of tank	Litre	22000	
2.3.3	Transfer pump			
2.3.4	- Type	-	Mobile skid mounted	
2.3.5	- Number of pumps	Nos.	As per PTS clause no.30.1.1	
2.3.6	- Pumping capacity	LPH	3000	
2.3.7	- Duty of pump-motors	-	Continuous	
2.3.8	- Insulation class and protection class of pump-motors	-	F, IP-55	
2.4	Air dryers			
2.4.1	- Number supplied	Nos.	As per PTS clause no.30.1.1	
2.4.2	- Capacity of air dryer	m^3/min.	>2	
2.5	Oil Hoses			
2.5.1	- Number	Nos.	As per the requirement and approval during detailed engineering	
2.6	Evacuation system for transformer tanks			
2.6.1	- Number	Nos.	As per PTS clause no.30.1.1	
2.6.2	- Pumping capacity of vacuum pumps	Lpm	As per the requirement and approval during detailed engineering	
2.6.3	- Duty of pump-motors	-	Continuous	
2.6.4	- Insulation class and protection class of pump-motors	-	F, IP-55	

30 OIL HANDLING SYSYTEM

30.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
2.7	Vacuum Hoses			
2.7.1	- Number	Nos.	As per the requirement and approval during detailed engineering	
3	**Lubricating oil system**			
3.1	Capabilty of lubricating oil purifying plant, after not more than two passes			
3.1.1	Moisture content	PPM	<50	
3.1.2	Free water reduction	%	100	
3.1.3	Filtration	micron	Not more than 1	
3.1.4	Centrifuge type skid mounted plant			
3.1.4.1	- Number supplied	Nos.	As per PTS clause no.30.1.2	
3.1.4.2	- Rate of oil flow	LPH	1200	
3.1.4.3	- Pumping capacity	LPH	1200	
3.1.4.4	- Total heating capacity	kW	As per the requirement and approval during detailed engineering	
3.2	Tyre mounted lubrication oil tanks			
3.2.1	- Number	Nos.	As per PTS clause no.30.1.2	
3.2.2	- Capacity	Litre	5000	
3.3	Transfer pump			
3.3.1	- Number of pumps	Nos.	As per PTS clause no.30.1.2	
3.3.2	- Pumping capacity	LPH	1200	
3.3.3	- Duty of pump-motors	-	Continuous	
3.3.4	- Insulation class and protection class of pump-motors	-	F, IP-55	
3.4	Oil Hoses			
3.4.1	- Number	Nos.	As per the requirement and approval during detailed engineering	
3.4.2	- Size	mm		
3.4.3	- Minimum length	m		
3.4.4	- Flow rate	Lpm		

30 OIL HANDLING SYSYTEM

30.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation /seal / signature
4	**Material/ Standard/Class/Grade/ Type for**			
4.1	Oil tank	-	Plate steel conforming to ASTM A516 Grade-60 in accordance with part UW of the ASME Code for Unfired Pressure Vessels, Section VIII	
5	Transformer evacuation system as per clause no. 30.3.1.2 of PTS	-	Yes	
6	Compliance of latest standards as per PTS clause no. 30.5.1	-	Yes	
7	Complete Compliance of Specification	-	Yes	

31 MECHANICAL WORKSHOP

31.1	**Guaranteed Technical Particulars**			
Item / Clause No.	**Parameter**	**Unit**	**Requirement**	**Bidder's confirmation /seal / signature**
1	Complete compliance to PTS (Chapter - 31) with reputed International / National makes	-	Yes	

32 ELEVATOR

32.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
1	**ELEVATOR**			
1.1	Type	-	Passenger	
1.2	Rated capacity of elevator	Kg / persons	1088 / 16	
1.3	Levelling accuracy	mm	± 5mm	
1.4	Factor of safety			
1.4.1	- Wire ropes	-	6(minimum)	
1.4.2	- Other parts	-	5(minimum)	
1.5	Rated speed (at rated load)	m/sec	1	
1.6	Number of landings	Nos.	6	
1.7	Lifting height	m	23.7	
1.8	Well dimensions	mmxmm	2500 X 2100	
1.9	Motor			
1.9.1	Rated power	kW	Vendor to specify	
1.9.2	Rated voltage	V	415	
1.9.3	Rated frequency	Hz	50	
1.9.4	Relative duty factor	%	40	
1.9.5	Degree of protection	-	IP 55	
1.9.6	Type of speed control	-	VVVF	
1.10	Material			
1.10.1	- car frame	-	Mild steel	
1.10.2	- car enclosure	-	Stainless steel	
1.10.3	- car doors	-	Stainless steel	
1.10.4	- platform	-	Stainless steel	
1.11	Two years of service / maintenance	-	Yes	
1.12	Safety certification from concerned authority may be submitted	-	Yes	
1.13	Compliance of latest standards as per clause no. 32.5.1 of PTS	-	Yes	
1.14	Provisions for emergency exit as per clause no. 32.5.4 of PTS	-	Yes	
1.15	Complete Compliance of Specification	-	Yes	

33 SECURITY AND SURVEILLANCE SYSTEM

33.1 Guaranteed Technical Particulars

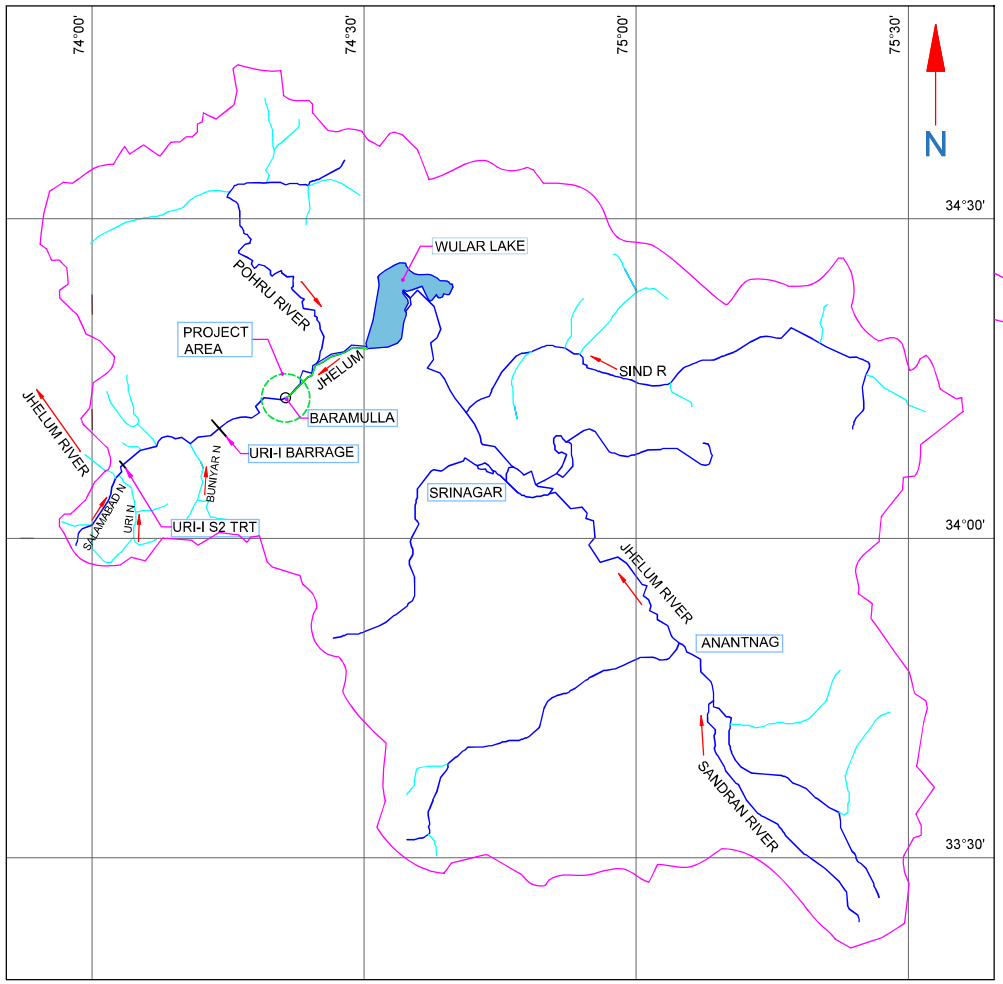
Item / Clause No.	Parameter	Unit	Requirement	Bidder's confirmation / seal / signature
A	**ACCESS CONTROL SYSTEM**			
1	**Performance data**			
1.1	Interfacing with plant LAN	-	Yes	
1.2	Interfacing with CCTV system	-	Yes	
1.3	Interfacing between power house and dam complex	-	Yes	
2	**Characteristic data**			
2.1	Access control panel			
2.1.1	Type	-	Modular	
2.1.2	Number of time Zones	Nos.	To be decided during detailed engineering	
2.2	Proximity card reader			
2.2.1	Minimum number of units	Nos.	>10 or as decided during detailed engineering	
2.2.2	Output type	-	Digital	
2.3	Access control software			
2.3.1	Password facility	-	Yes	
2.4	Proximity Card			
2.4.1	Number	-	> 300 or as decided during detailed engineering	
B	**CCTV SURVEILLANCE SYSTEM**			
1	**Performance data**			
1.1	Interfacing with plant LAN	-	Yes	
1.2	Interfacing with access control system	-	Yes	
1.3	Interfacing between power house and dam complex	-	Yes	
2	**Characteristic data**			
2.1	Camera			
2.1.1	Type	-	PTZ	
2.1.2	Minimum Number of units	Nos.	To be decided during detailed engineering	
2.1.3	Angle of rotation	Degree	360^{o}; valuable scan speed (1-40 degree/sec)	
2.1.4	Minimum illumination	Lux	0.5 lux(colour); 0.05 lux (B/W)	
2.1.5	Signal-to-noise ratio	dB	> 50	

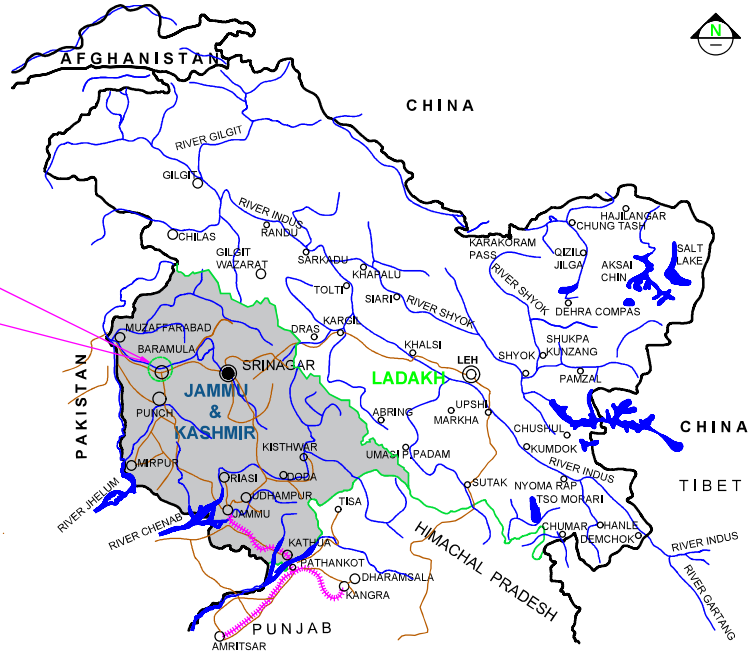
2.2	Portable camera			
2.2.1	Minimum number of units	Nos.	2	
2.2.2	Angle of rotation	Degree	360°; valuable scan speed (1-40 degree/sec)	
2.2.3	Minimum illumination	Lux	0.5 lux(colour); 0.05 lux (B/W)	
2.2.4	Signal-to-noise ratio	dB	> 50	
2.3	Pan tilt & zoom unit			
2.3.1	Pan range	degrees	0-360°	
2.3.2	Tilt range	degrees	+2 to -92°	
2.3.3	Protection class (IP)	-	IP 66	
2.4	Camera housings			
2.4.1	Protection class (IP)	-	IP 66	
2.4.2	Material construction	-	weather proof environment housing made of Aluminium	
2.4.3	Operating temperature range	oC	-0.5° to 40°C	
2.5	Digital video recorder			
2.5.1	Minimum number of units	Nos.	1	
2.5.2	Remote control		Yes	
2.6	High resolution colour monitors			
2.6.1	Minimum number of units	Nos.	4 nos in security & servillance room	
2.6.2	Screen dimension	inch	26	
2.6.3	Minimum resolution	pixel	1080P (1920X1080)	
2.7	Interfacing accessory	-	Yes	
2.8	Personal Computer			
2.8.1	Type	-	Latest versions of processor & windows OS	
2.8.2	Minimum number of units	Nos.	5	
2.8.3	SSD capacity	TB	2	
2.9	Printer			
2.9.1	Type / designation	-	high speed laser type	
2.9.2	Minimum number of units	Nos.	4	
2.9.3	Print speed	pages/ minute	15	
2.10	Key Board & mouse		wireless	
2.10.1	Minimum number of units	Nos.	5	
2.11	Large screen display-Smart FHD LED TV			
2.11.1	Minimum number of units	Nos.	1	
2.11.2	Screen dimension	inch	85	
C	Complete Compliance of Specification	-	Yes	

Volume-IV-Drawings

LIST OF TENDER DRAWINGS OF URI I STAGE-II HYDROELECTRIC PROJECT (J & K)

Sr. No.	DRAWING TITLE	DRAWING NO.	Sr. No.	DRAWING TITLE	DRAWING NO.
	LAYOUT DRAWINGS			**E&M DRAWINGS**	
1	PROJECT LOCATION MAP	NHUR-I(II)-1AT1-41-GA-001	1	POWER HOUSE DRAINAGE AND DEWATERING SYSTEM	NH/DEM/ URI I STG- II /D&D/01
2	PROJECT LAYOUT PLAN	NHUR-I(II)-1AT1-41-GA-002	2	GENERAL SINGLE LINE DIAGRAM	NH/DEM/ URI I STG- II /CP/01
3	POWER HOUSE AREA GA -PLAN	NHUR-I(II)-1AT1-41-GA-04	3	PROTECTIVE RELAYING & METERING DIAGRAM (SH.1 OF 2)	NH/DEM/ URI I STG- II /PS/02
4	POWER HOUSE AREA GA -SECTION	NHUR-I(II)-1AT1-41-GA-05	4	PROTECTIVE RELAYING & METERING DIAGRAM (SH.2 OF 2)	NH/DEM/ URI I STG- II /PS/02
5	POWER HOUSE AREA CAVERNS - PLAN	NHUR-I(II)-1AT1-41-GA-043	5	SINGLE LINE DIAGRAM FOR GIS	NH/DEM/ URI I STG- II /SLD/02
6	POWER HOUSE AREA CAVERNS - SECTION	NHUR-I(II)-1AT1-41-GA-044	6	SINGLE LINE DIAGRAM - UNIT AUXILIARY BOARD	NH/DEM/ URI I STG- II /LT/01
7	POWER HOUSE AREA CAVERNS - LONGITUDINAL SECTION	NHUR-I(II)-1AT1-41-GA-045	7	SINGLE LINE DIAGRAM - STATION SERVICE BOARD	NH/DEM/ URI I STG- II /LT/02
8	POWER HOUSE MACHINE HALL DRAFT TUBE AND DRAINAGE GALLERY - PLAN AND SECTION	NHUR-I(II)-1AT1-41-GA-046	8	SINGLE LINE DIAGRAM- MV SWITCHGEAR AND AUXILIARY TRANSFORMER	NH/DEM/ URI I STG- II /CP/05
9	POWER HOUSE PLAN AT EL. 1223.80 (RUNNER REMOVEL FLOOR) / MIV FLOOR	NHUR-I(II)-1AT1-41-GA-047	9	SINGLE LINE DIAGRAM - 220V DC STATION SERVICE1(SH 1 of 2)	NH/DEM/ URI I STG- II /DC/01
10	POWER HOUSE PLAN AT EL. 1228.70.80 (CENTER LINE OF MACHINE)	NHUR-I(II)-1AT1-41-GA-048	10	SINGLE LINE DIAGRAM - 220V DC STATION SERVICE1(SH 2 of 2)	NH/DEM/ URI I STG- II /DC/01
11	POWER HOUSE PLAN AT EL. 1231.10 TURBINE FLOOR	NHUR-I(II)-1AT1-41-GA-049	11	SINGLE LINE DIAGRAM - 220V DC STATION SERVICE2	NH/DEM/ URI I STG- II /DC/02
12	POWER HOUSE PLAN AT EL. 1235.10 (GENERATOR FLOOR)	NHUR-I(II)-1AT1-41-GA-050	12	PROTECTION RELAY NETWORK	NH/DEM/ URI I STG- II /RELAY NW/01
13	POWER HOUSE PLAN AT EL. 1239.80 (MACHINE FLOOR LEVEL)	NHUR-I(II)-1AT1-41-GA-051	13	SINGLE LINE DIAGRAM COOLING WATER SYSTEM	NH/DEM/ URI I STG- II /CW/01
14	TRANSFORMER CAVERN PLAN EL. 1239.80 AND SECTION	NHUR-I(II)-1AT1-41-GA-053	14	HVAC SYSTEM - AIR FLOW DIAGRAM	NH/DEM/ URI I STG- II /AC/01
15	TRANSFORMER CAVERN PLAN EL. 1239.80 AND SECTION	NHUR-I(II)-1AT1-41-GA-054	15	COOLING WATER SYSTEM DIAGRAM FOR VENTILATION SYSTEM	NH/DEM/ URI I STG- II /AC/02
16	POWER HOUSE VENTILATION TUNNEL PLAN	NHUR-I(II)-1AT1-41-GA-063	16	FIRE FIGHTING SYSTEM	NH/DEM/ URI I STG- II /FF/01
17	POWER HOUSE AREA CAVERN ROCK SUPPORT DETAILS	NHUR-I(II)-1AT1-41-GA-064	17	POWER HOUSE LIMIT OF SUPPLY	NH/DEM/ URI I STG- II /PH/01
			18	CT / PT DETAILS OF BUS DUCT	NH/DEM/ URI I STG- II /BD/01
			19	COMPUTERIZED CONTROL AND MONITORING SYSTEM	NH/DEM/ URI I STG- II /CMS/02
			20	SCHEMATIC DIAGRAM COMPRESSED AIR SYSTEM	NH/DEM/ URI I STG- II /CAS/02
			21	ROTOR LEAD CONNECTION THROUGH SHAFT (TYPICAL) & ROTOR POLE INTERSECTION (TYPICAL)	NH/DEM/ URI I STG- II /GEN/01
			22	Power House Crane Approches	NH/DEM/ URI I STG- II /ET/01





LEGEND

1. INTERNATIONAL BOUNDARY.
2. STATE BOUNDARY
3. RIVER
4. ROAD
5. NALAH
6. STATE HEADQUARTER
7. DISTRICT
8. OTHER TOWNS

TENDER DRAWING
NOT FOR CONSTRUCTION

SCALE:-

0 10 20 30 40 50 KM.

(SCALE 1:1000)

एनएचपीसी NHPC A Navratna Company

एन एच पी सी लिमिटेड NHPC Limited

उरी I द्वितीय चरण जल विद्युत परियोजना (जम्मू एण्ड कश्मीर)
URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

PROJECT AREA
VICINITY MAP

NO.	DATE	REVISION OR ISSUES	BY.	CH.	APP.
		ISSUED FOR TENDER			

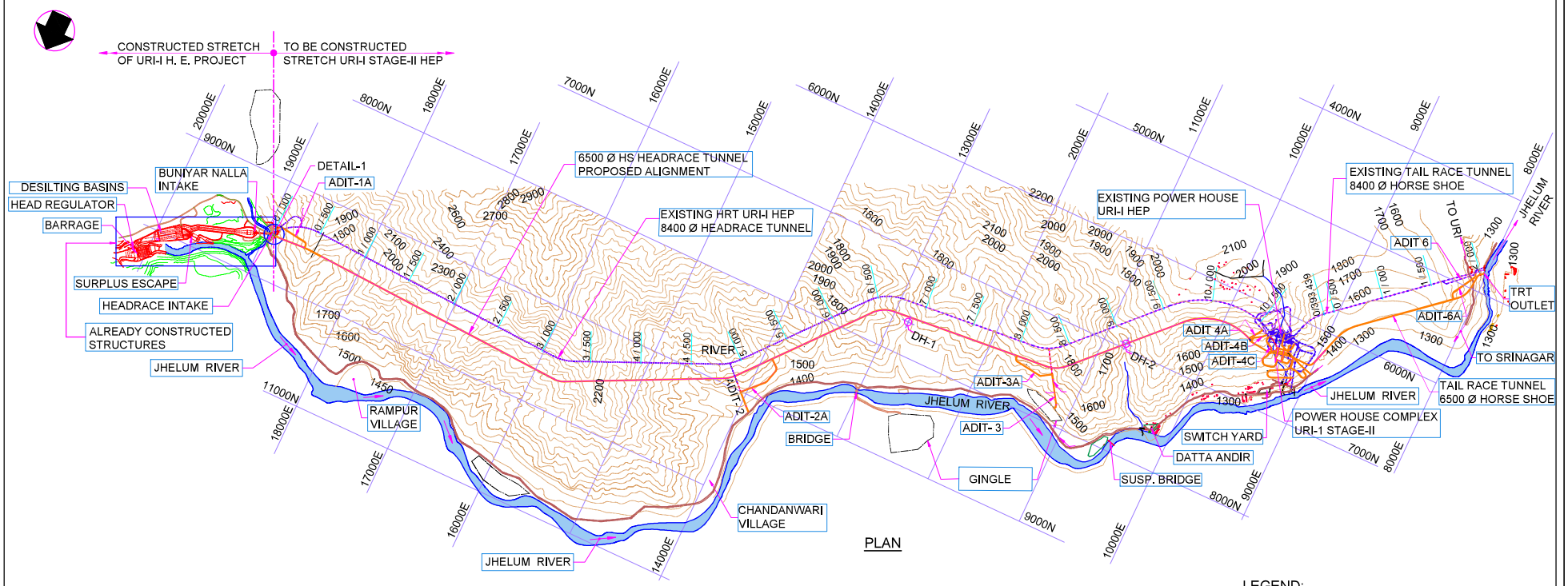
DESIGN MEMO NO.

DRAWN	SUBMITTED	RECOMMENDED		APPROVED
ASLAM . A	ASLAM . A	VINOD. K		SAKET KUMAR

DATE MARCH,2025 | DRG. NO. NHUR-I(II) | 1AT1 | 41 | GA | 001 | 00

DRG. NO.NHUR-I(II)-1AT1-41-GA-001-00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



PLAN

POINT	CO-ORDINATES	
	NORTHING	EASTING
HRT 1	9550.450	18899.78

LEGEND:-

- URI-I STAGE - II
- EXISTING URI-I STAGE - I

TENDER DRAWING
NOT FOR CONSTRUCTION

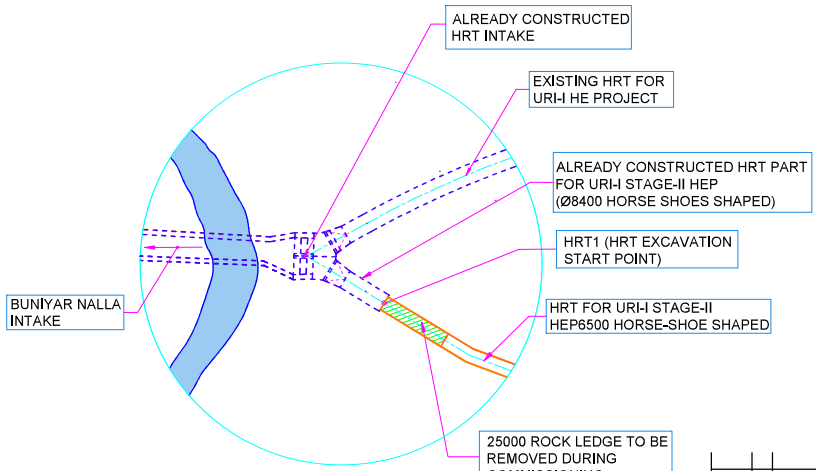
SCALE:

0 400 800 1200 1600 2000 M.

(SCALE 1:40000)

NOTES :-

1. ALL DIMENSIONS,LEVELS AND GRID ARE IN METRES.
2. THIS DRAWING IS FOR TENDER PURPOSE ONLY.
3. STRIP SURVEY & SURVEY NEAR ADITS,RECEIVED FROM PID VIDE LETTER NO NH/CO/PID/2021/443 DATED 10.08.2021 AND ADIT LOCATION VERIFIED BY PID VIDE E-IOM NO.NH/CO/PID/2023/722 DATED 15.11.2023. 50M CONTOUR IS TAKEN FROM COMPLETION REPORT OF URI STAGE-1.
4. EXISTING STRUCTURES SHOWN IN THE DRAWING ARE OF URI-I HEP AS PER PROJECT COMPLETION REPORT.
5. THE BLASTING SHALL BE DESIGNED BY THE CONTRACTOR FOR EXCAVATION OF ALL SURFACE/ UNDERGROUND WORKS TO BE PERFORMED AND SHALL BE CONSTANTLY MONITORED CONSIDERING THE SAFETY OF THE EXISTING STRUCTURES OF URI-I H.E. PROJECT.



DETAIL-1
(NTS)

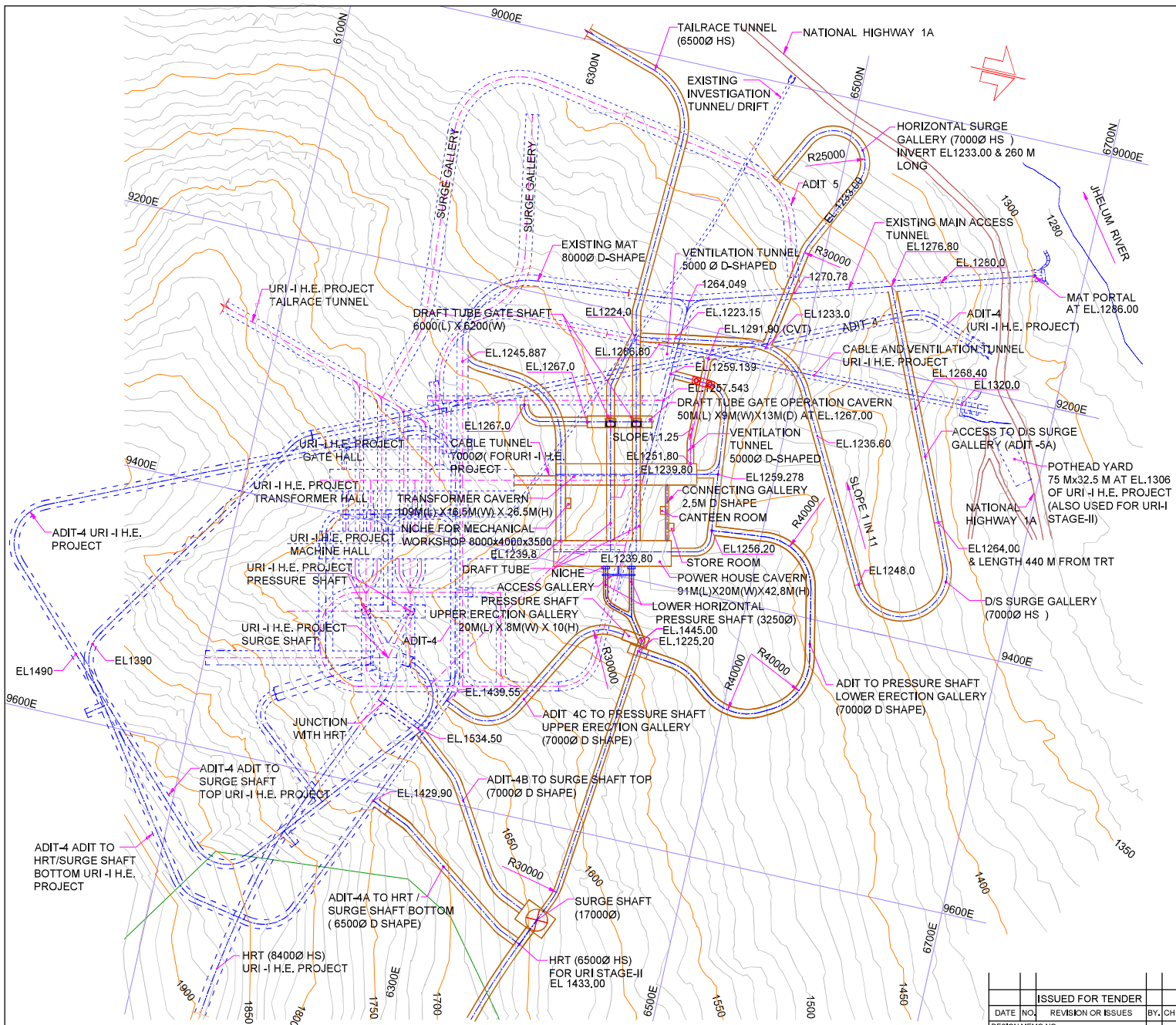
		ISSUED FOR TENDER							
DATE	NO.	REVISION OR ISSUES	BY.	CH.	APP.	DRAWN	SUBMITTED	RECOMMENDED	APPROVED
DESIGN MEMO NO.						DATE: MARCH,2025	DRG. NO.	NHUR-I(II)	1AT1 41 GA 002 00

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NHPC Limited
उरी I द्वितीय चरण जल विद्युत परियोजना (जम्मू एण्ड कश्मीर)
URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

PROJECT LAYOUT PLAN

DRG. NO.NHUR-I(II) -1AT1 - 41 - GA - 002 - 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETERS ; LEVELS, AND GRID ARE IN METRES.
2. THIS DRAWING IS DEVELOPED BASED ON POWER HOUSE AREA SURVEY RECEIVED FROM PID VIDE LETTER NO : NH/CO/PID/2021/443 DATED 10.08.2021 AND ADIT LOCATION VERIFIED BY E-IOM NH/CO/PID/2023/722 DATED 15.11.2023.
3. PRELIMINARY LAYOUT HAS BEEN DEVELOPED UTILIZING AVAILABLE DATA.
4. VARIOUS SIZE AND LEVELS HAS BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.

LEGEND:-

URI-I STAGE - II

EXISTING URI -I H.E. PROJECT

TENDER DRAWING
NOT FOR CONSTRUCTION

0 30 60 90 120 150 M.

(SCALE 1:3000)

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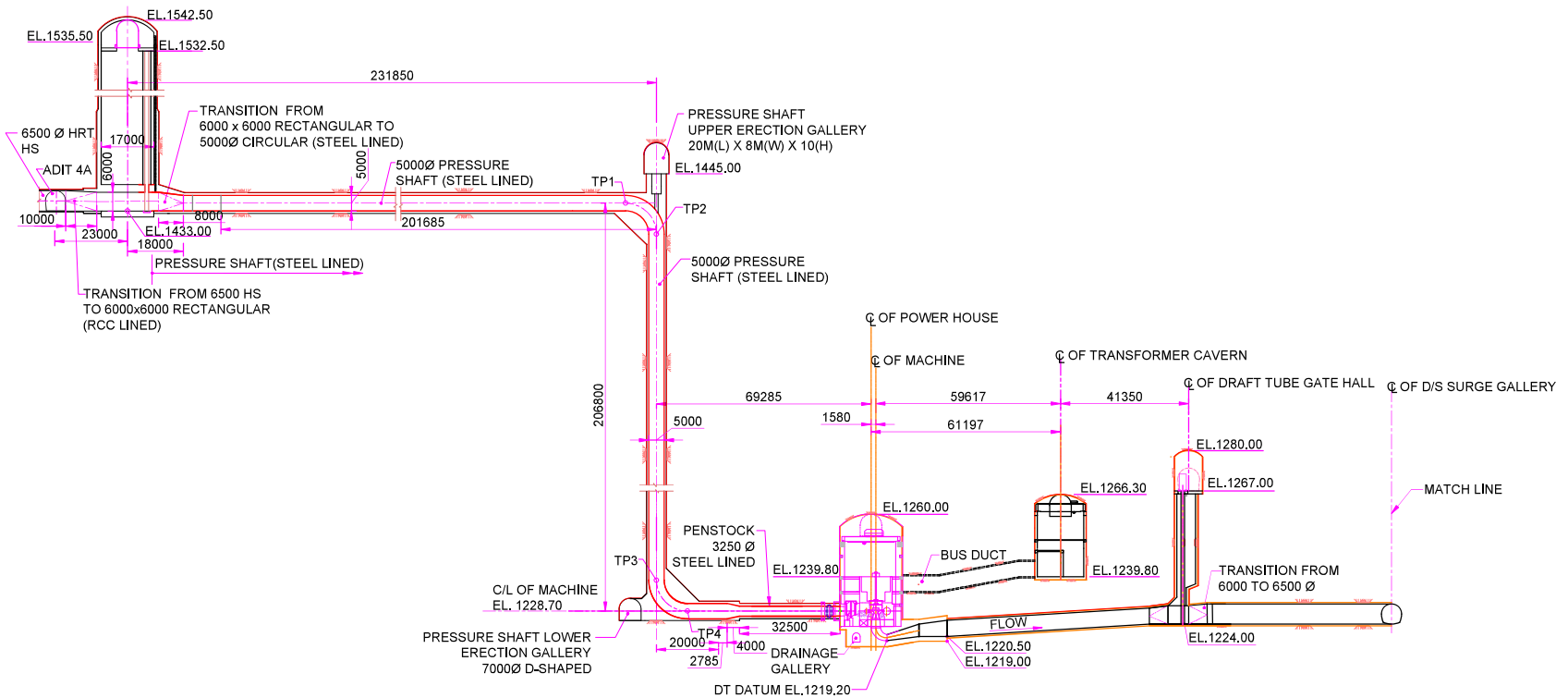
उरी I द्वितीय चरण जल विद्युत परियोजना (जम्मू एण्ड कश्मीर)
URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

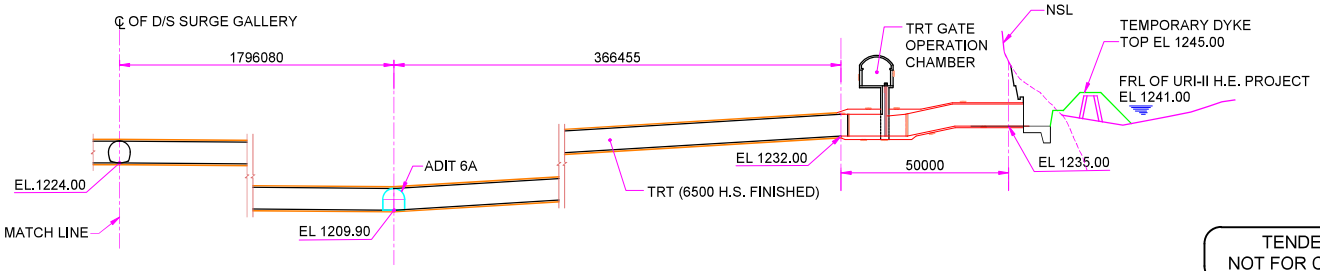
POWER HOUSE AREA GENERAL ARRANGEMENT PLAN

ISSUED FOR TENDER									
DATE	NO.	REVISION OR ISSUES	BY.	CH.	APP.	DRAWN	SUBMITTED	RECOMMENDED	APPROVED
						S. TANWAR	VINOD KUMAR	SAKET KUMAR	RAJESH KUMAR
DESIGN MEMO NO.						DATE: MARCH,2025	DRG. NO.	NHUR-I(II)	4AT1 41 GA 004 00

DRG. NO. NHUR-I(II) - 4AT1 - 41 - GA - 004 - 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016





LONGITUDINAL SECTION OF SURGE SHAFT DOWNSTREAM
WATER CONDUCTOR SYSTEM

NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETRE AND ELEVATIONS IN METRE.
2. THE BLASTING SHALL BE DESIGNED BY THE CONTRACTOR FOR EXCAVATION OF ALL SURFACE/ UNDERGROUND WORKS TO BE PERFORMED AND SHALL BE MONITORED CONSIDERING THE SAFETY OF THE EXISTING STRUCTURES OF URI-I H. E. PROJECT.

SCALE:

0 15 30 45 60 75 M

(SCALE:- 1500)

TENDER DRAWING
NOT FOR CONSTRUCTION

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URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

POWER HOUSE AREA
GENERAL ARRANGEMENT
SECTION

	NO.	REVISION OR ISSUES	BY.	CH.	APP.
		ISSUED FOR TENDER			

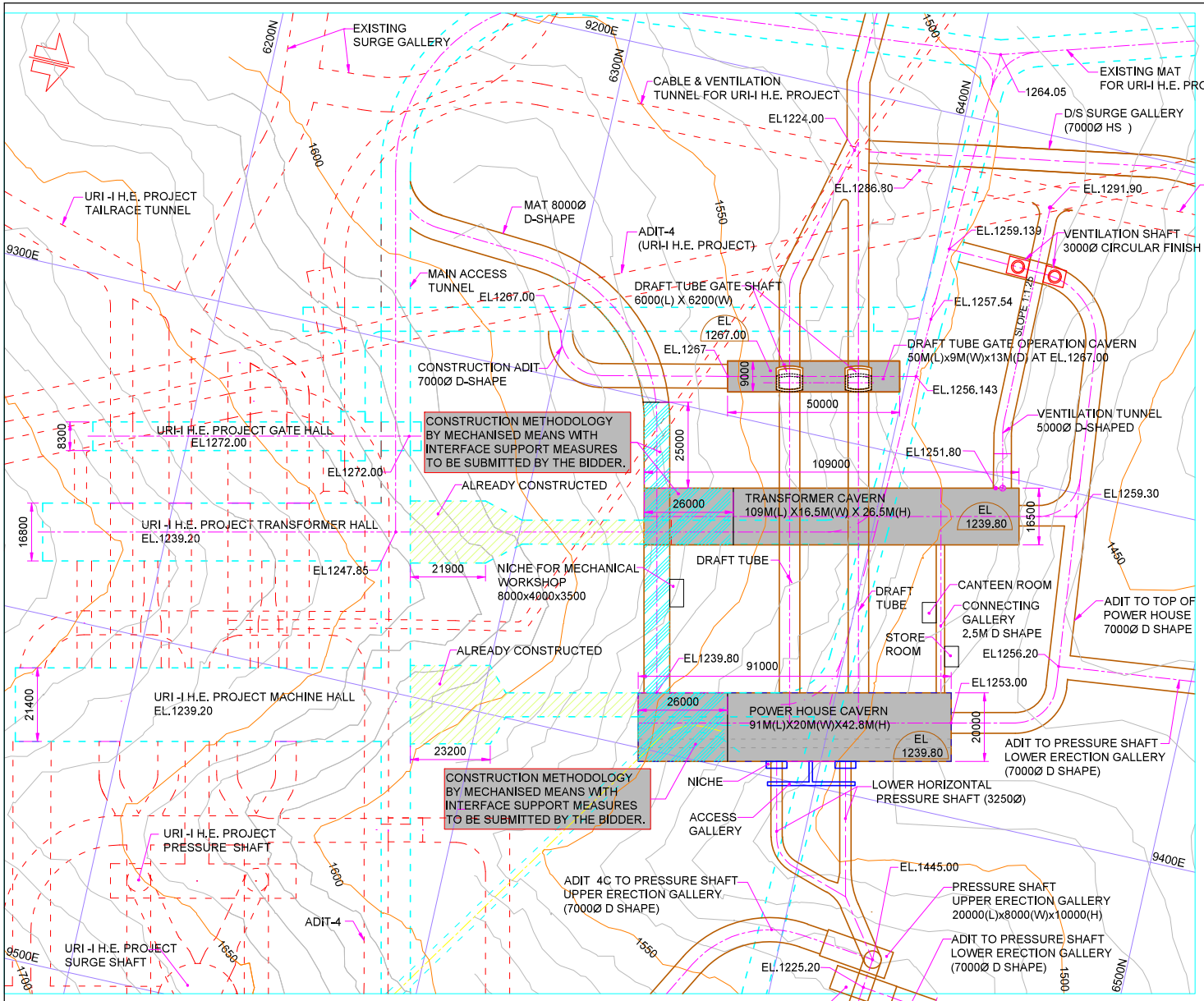
DESIGN MEMO NO. डिजाइन मेमो संख्या

DRAWN	SUBMITTED	RECOMMENDED		APPROVED
उदघिता ASLAM . A	प्रस्तुत ASLAM . A	अनुशंसित VINOD. K		अनुमोदन SAKET KUMAR

DATE दिनांक MARCH,2025 | DRG. NO. चित्र संख्या | NHUR-I(II) | 4AT1 | 41 | GA | 005 | 00

DRG. NO. NHUR-I(II) -4AT1 - 41 - GA - 005 - 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



PLAN

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETERS ; LEVELS, AND GRID ARE IN METRES.
2. THIS DRAWING IS DEVELOPED BASED ON POWER HOUSE AREA SURVEY RECEIVED FROM PID VIDE LETTER NO : NH/CO/PID/2021/443 DATED 10.08.2021 AND ADIT LOCATION VERIFIED BY E-IOM NH/CO/PID/2023/722 DATED 15.11.2023.
3. PRELIMINARY LAYOUT HAS BEEN DEVELOPED UTILIZING AVAILABLE DATA.
4. VARIOUS SIZE AND LEVELS HAS BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.
5. THE BLASTING SHALL BE DESIGNED BY THE CONTRACTOR FOR EXCAVATION OF ALL UNDERGROUND EXCAVATION WORKS TO BE PERFORMED AND SHALL BE MONITORED CONSIDERING THE SAFETY OF THE EXISTING STRUCTURES OF URI-I H.E. PROJECT.

LEGEND:-

- URI-I STAGE - II
- EXISTING URI-I H.E. PROJECT
- CONSTRUCTION METHODOLOGY BY MECHANISED MEANS OF THE INTERFACE SUPPORT MEASURES TO BE SUBMITTED BY THE BIDDER.

TENDER DRAWING
NOT FOR CONSTRUCTION

0 12 24 36 48 60 M.

(SCALE 1:1200)

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URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

POWER HOUSE AREA CAVERNS GENERAL ARRANGEMENT PLAN

DATE	NO.	REVISION OR ISSUES	BY.	CH.	APP.
		ISSUED FOR TENDER			

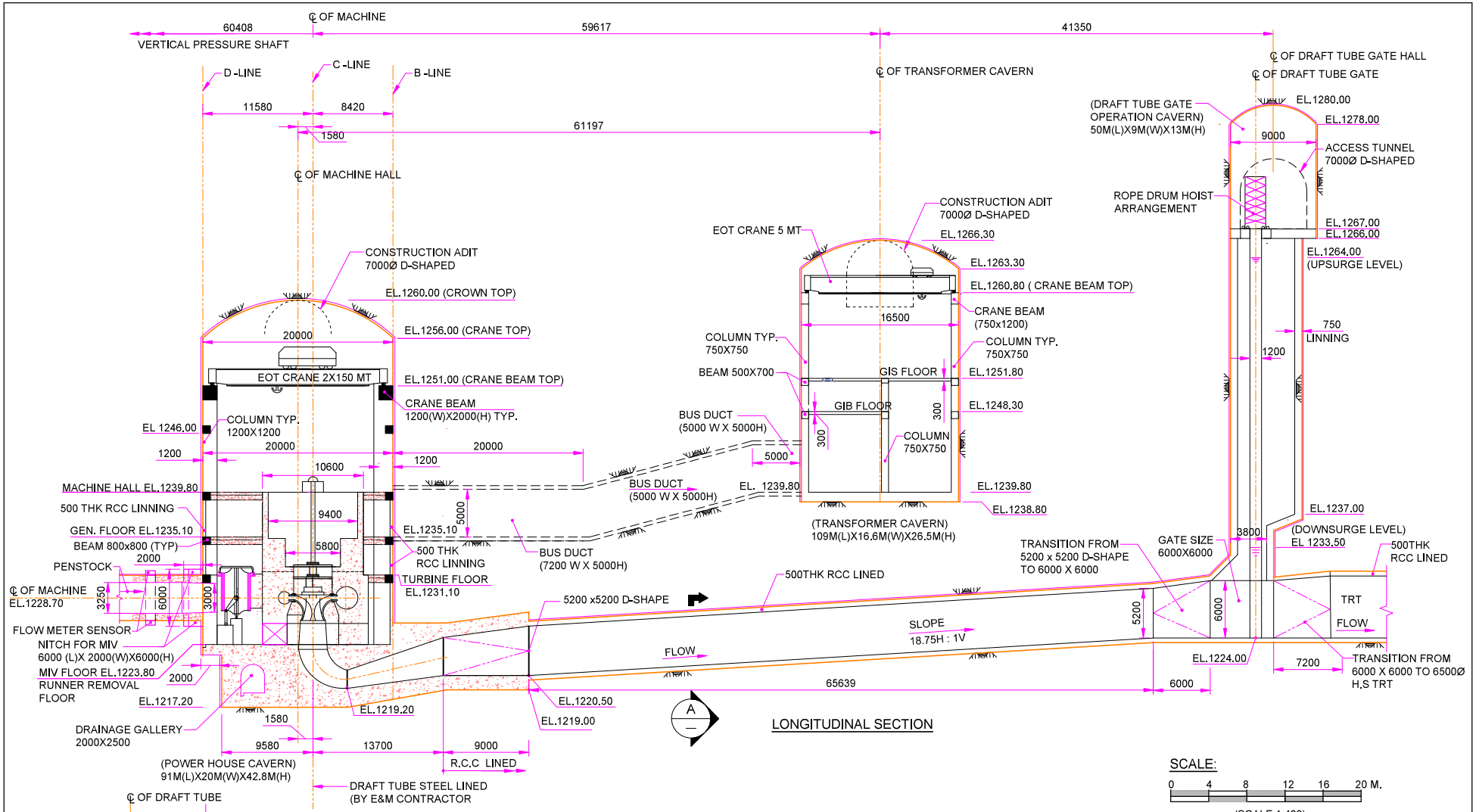
DESIGN MEMO NO.

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
S.TANWAR	S.TANWAR	VINOD. K	SAKET KUMAR

DATE: MARCH,2025 | DRG. NO.: NHUR-I(II) | 4CT1 | 41 | GA | 043 | 00

DRG. NO. NHUR-I(II) - 4CT1 - 41 - GA - 043 - 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



TENDER DRAWING
NOT FOR CONSTRUCTION

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES , LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAVE BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAIL DESIGN .

DATE	NO.	REVISION OR ISSUES	BY.	CH.APP.
		ISSUED FOR TENDER		

DESIGN MEMO NO.

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NHPC Limited
उरी। द्वितीय चरण जल विद्युत परियोजना (जम्मू एण्ड कश्मीर)
URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

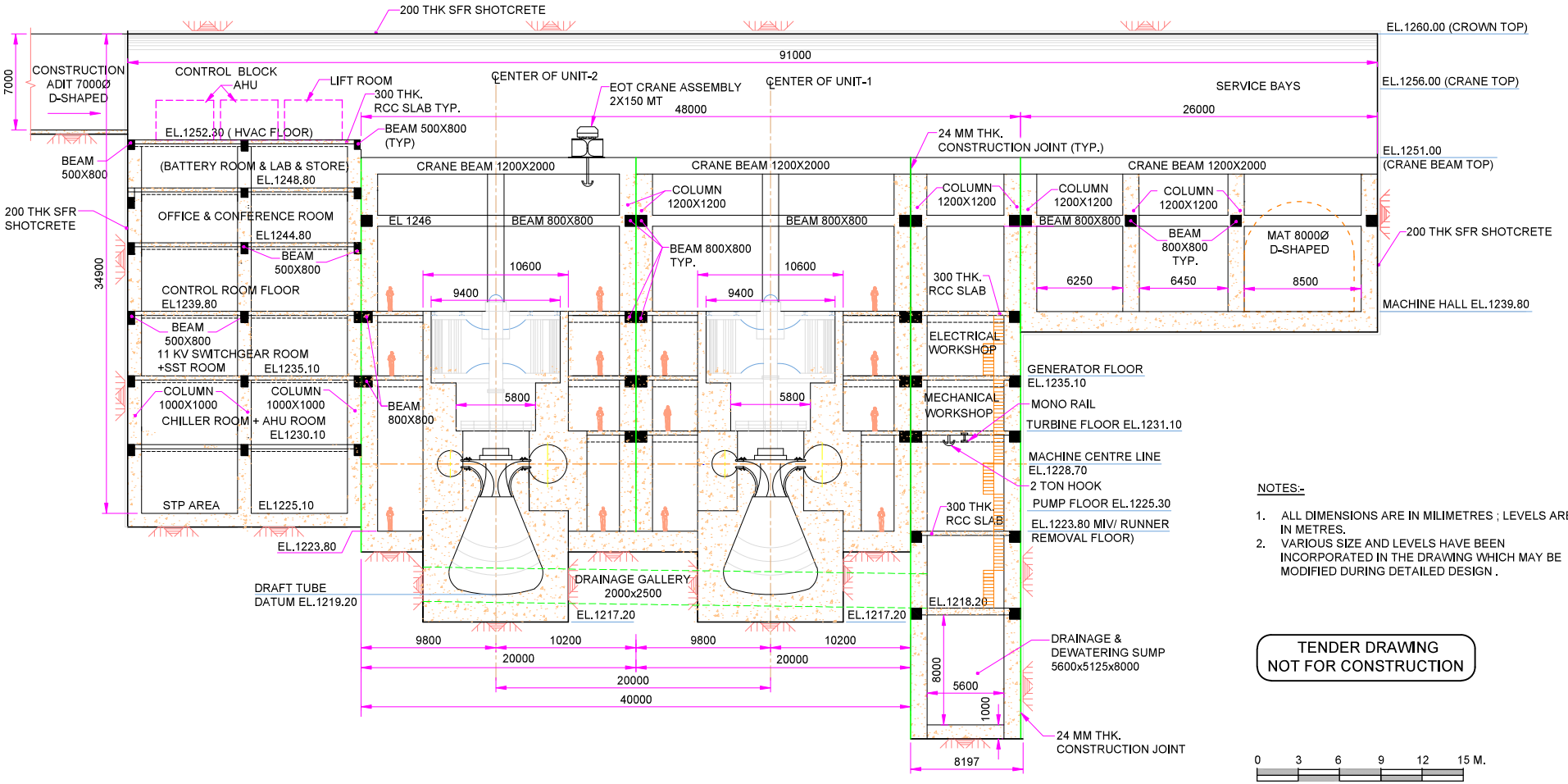
POWER HOUSE AREA CAVERNS
GENERAL ARRANGEMENT
SECTION

DRAWN	SUBMITTED	RECOMMENDED		APPROVED
S.TANWAR	S.TANWAR	VINOD.K		SAKET KUMAR

DATE: MARCH,2025 | DRG. NO.: NHUR-I(II) | 4CT1 | 41 | GA | 044 | 00

DRG. NO. NHUR-I(II) -4CT1 - 41 - GA - 044 - 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



LONGITUDINAL SECTION THROUGH CENTER LINE OF MACHINE

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES ; LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAVE BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN .

TENDER DRAWING
NOT FOR CONSTRUCTION

0 3 6 9 12 15 M.

(SCALE 1:300)

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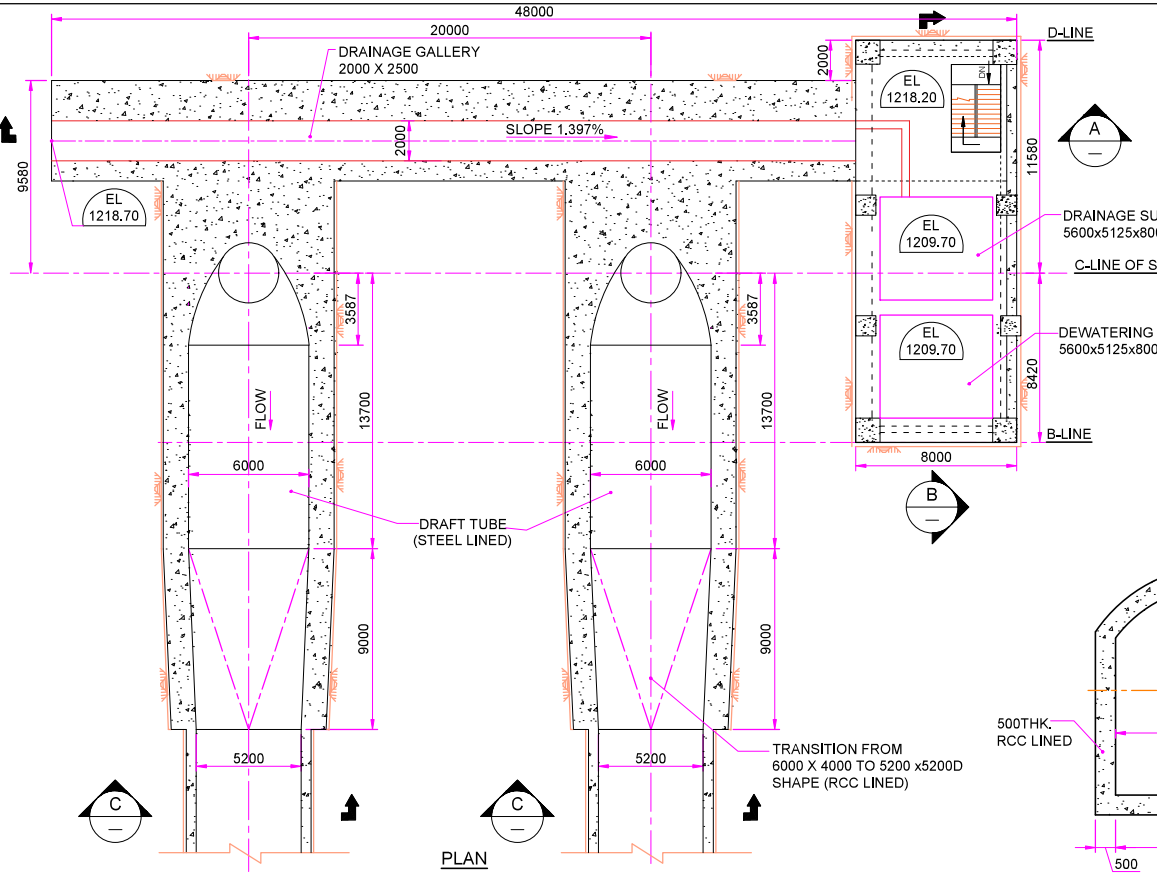
URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

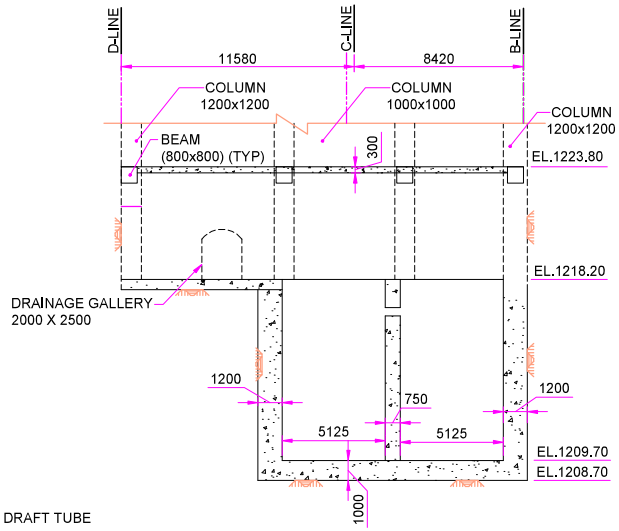
POWER HOUSE
LONGITUDINAL SECTION

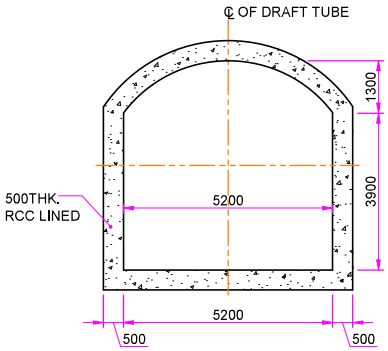
ISSUED FOR TENDER										
DATE	NO.	REVISION OR ISSUES	BY.	CH.	APP.	DRAWN	SUBMITTED	RECOMMENDED		APPROVED
						S.TANWAR	S.TANWAR	VINOD.K		SAKET KUMAR
DESIGN MEMO NO.						DATE: MARCH,2025	DRG. NO.	NHUR-I(II)	4CT1	41 GA 045 00

DRG. NO. NHUR-I(II)-4CT1 - 41 - GA - 045 - 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016

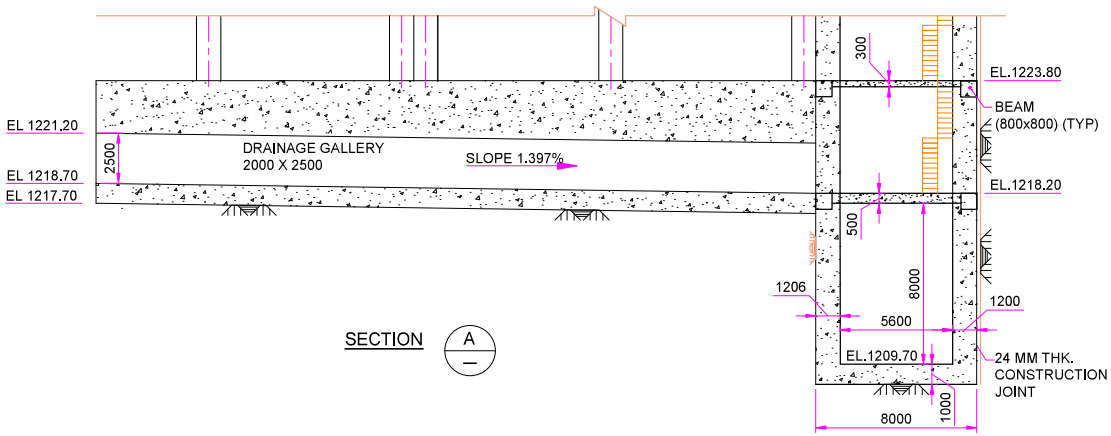




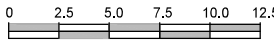


NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES ; LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAVE BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.
3. GRADE OF CONCRETE SHALL BE M25A40, AND FOR SECOND STAGE CONCRETE M35A20. CONFORMING SECTION 8.9 OF TECHNICAL SPECIFICATION .



TENDER DRAWING
NOT FOR CONSTRUCTION



(SCALE 1:250)

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NHPC Limited
उरी I द्वितीय चरण जल विद्युत परियोजना (जम्मू एण्ड कश्मीर)
URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

POWER HOUSE
DRAINAGE GALLERY & DRAFT TUBE
PLAN AND SECTION

NO.	REVISION OR ISSUES	DATE	BY.	CH.	APP.
	ISSUED FOR TENDER				

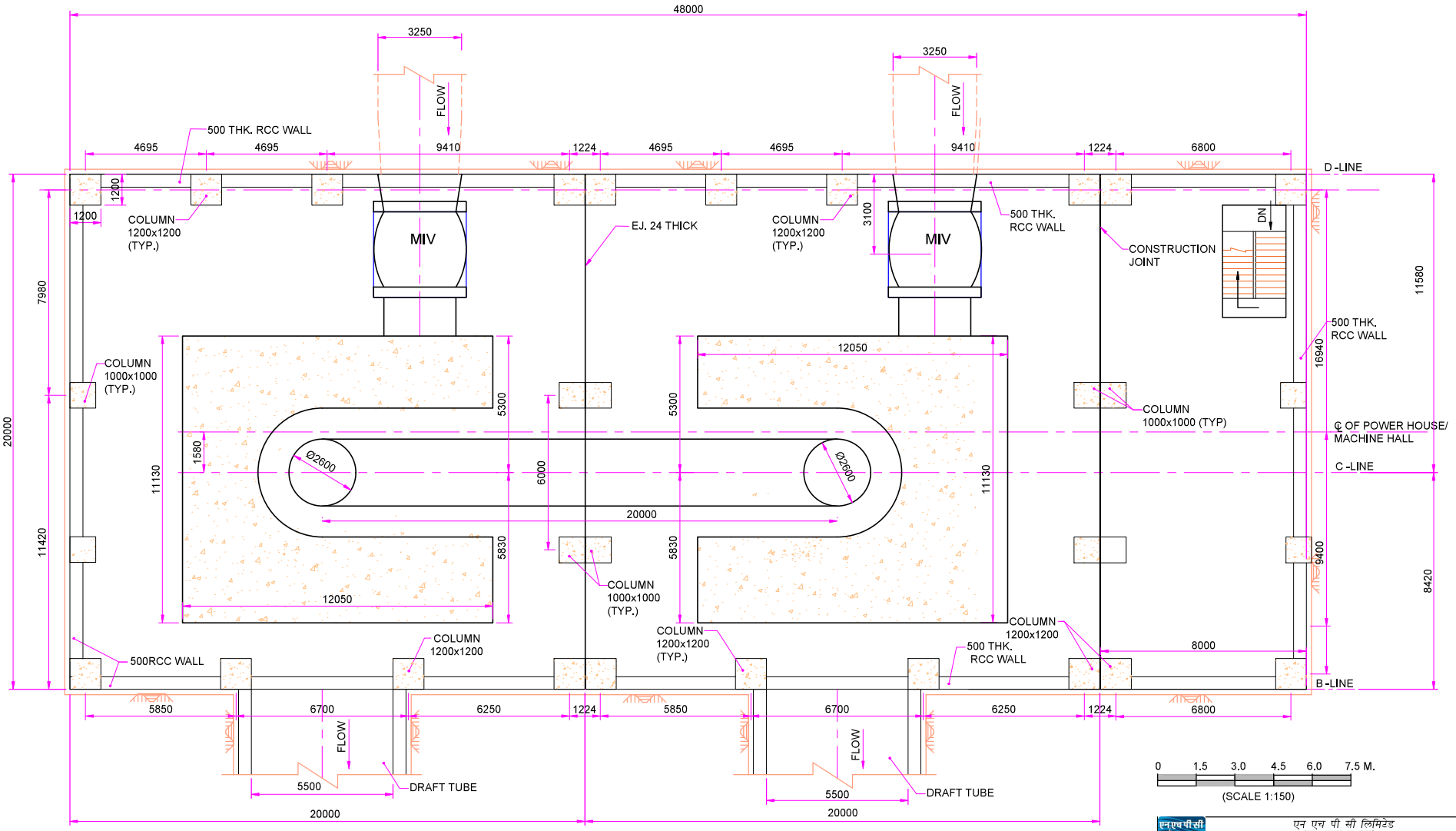
DESIGN MEMO NO.

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
S.TANWAR	S.TANWAR	VINOD.K	SAKET KUMAR

DATE: MARCH,2025 | DRG. NO.: NHUR-I(II) | 4CT1 | 41 | GA | 046 | 00

DRG. NO. NHUR-I(II)-4CT1 - 41 - GA - 046- 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



PLAN AT EL 1223.80 (MIV/RUNNER REMOVAL FLOOR)

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES ; LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAVE BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.
3. GRADE OF CONCRETE SHALL BE M25A40, AND FOR SECOND STAGE CONCRETE M35A20 CONFORMING TO SECTION B.5 OF TECHNICAL SPECIFICATION.

TENDER DRAWING
NOT FOR CONSTRUCTION

		ISSUED FOR TENDER		
DATE	NO.	REVISION OR ISSUES	BY.	CH.APP.

DESIGN MEMO NO.

एन एच पी सी लिमिटेड
NHPC Limited
उरी I द्वितीय चरण जल विद्युत परियोजना (जम्मू एण्ड कश्मीर)
URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

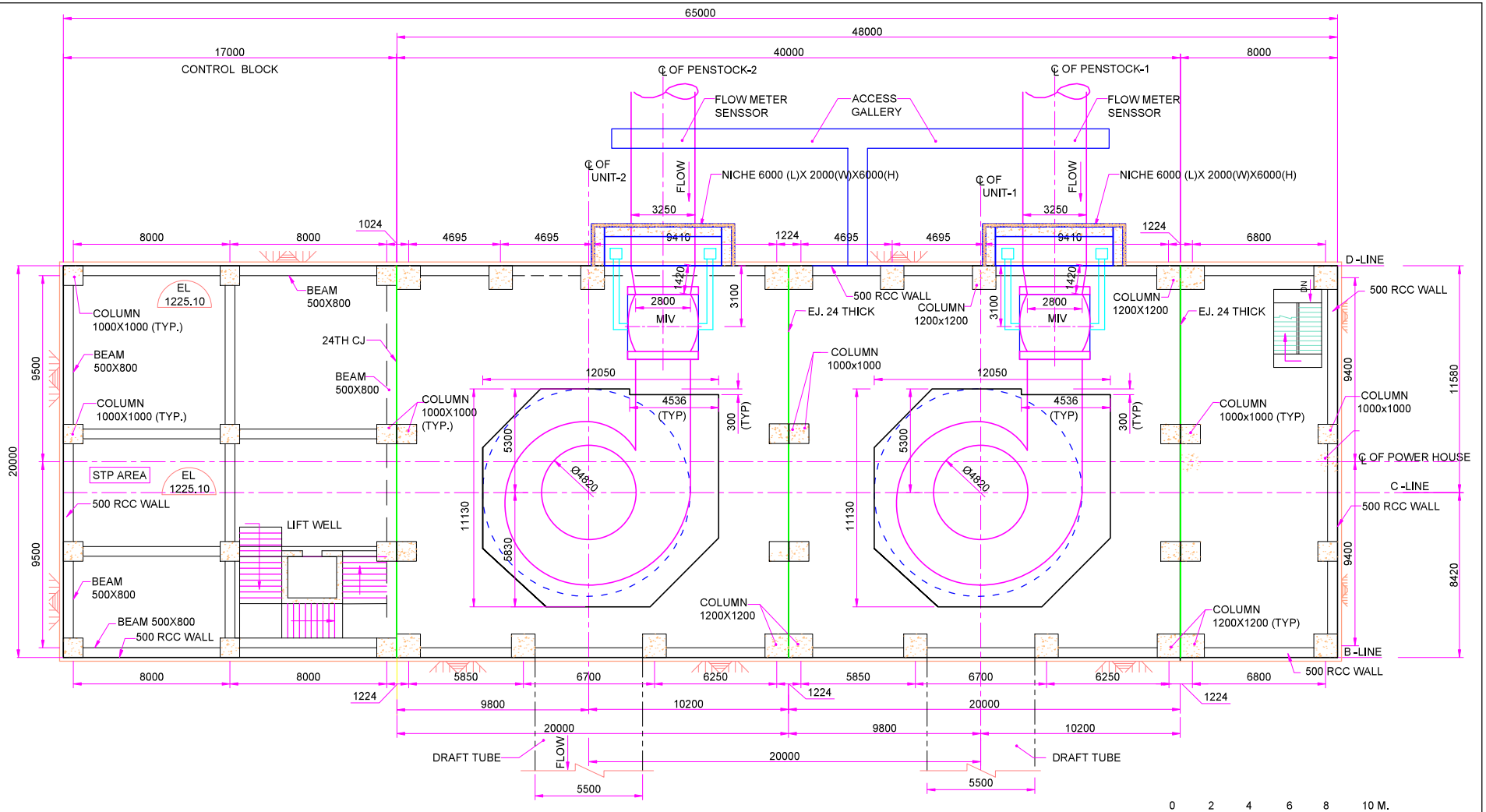
POWER HOUSE
RUNNER REMOVAL FLOOR
PLAN AT EL 1223.80

DRAWN	SUBMITTED	RECOMMENDED		APPROVED
उदेशित S.TANWAR	प्रस्तुत S.TANWAR	अनुशंसित VINOD.K		अनुमोदन SAKET KUMAR

DATE	DRG. NO.				
दिनांक MARCH,2025	चित्र संख्या NHUR-I(II)	4CT1	41	GA	047	00

DRG. NO. NHUR-I(II)-4CT1 - 41 - GA - 047 - 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



PLAN AT CENTER LINE OF MACHINE (EL1228.70)

0 2 4 6 8 10 M.

(SCALE 1:200)

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES; LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAVE BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.
3. GRADE OF CONCRETE SHALL BE M25A40 AND FOR SECOND STAGE CONCRETE M35A20 CONFORMING TO SECTION B.5 OF TECHNICAL SPECIFICATION.

TENDER DRAWING
NOT FOR CONSTRUCTION

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NHPC Limited
उरी। द्वितीय चरण जल विद्युत परियोजना (जम्मू एण्ड कश्मीर)
URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

POWER HOUSE
PLAN AT EL1228.70
CENTRE LINE OF MACHINE

DATE	NO.	REVISION OR ISSUES	BY.	CH.	APP.
		ISSUED FOR TENDER			

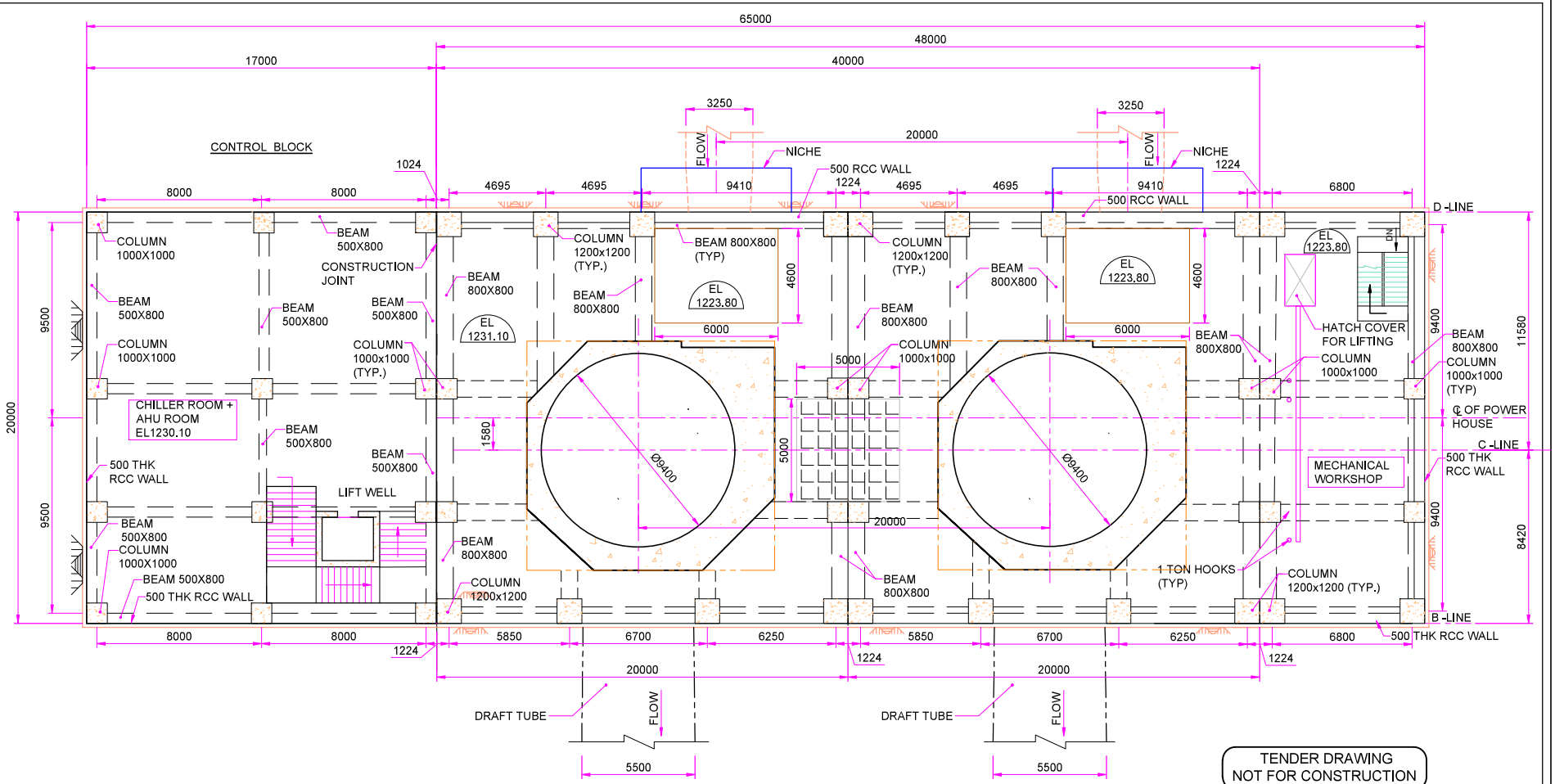
DESIGN MEMO NO.

DRAWN	SUBMITTED	RECOMMENDED		APPROVED
उदेश S.TANWAR	प्रस्तुत S.TANWAR	अनुशंसित VINOD.K		अनुमोदन SAKET KUMAR

DATE	DRG. NO.					
MARCH,2025	NHUR-I(II)	4CT1	41	GA	048	00

DRG. NO. NHUR-I(II)-4CT1 - 41 - GA - 048 - 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



PLAN AT EL 1231.10 (TURBINE FLOOR)

TENDER DRAWING
NOT FOR CONSTRUCTION

0 2 4 6 8 10 M.

(SCALE 1:200)

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES ; LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAS BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.
3. GRADE OF CONCRETE SHALL BE M25A40 AND FOR SECOND STAGE CONCRETE M35A20 CONFORMING TO SECTION B.5 OF TECHNICAL SPECIFICATION.

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NHPC Limited
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URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

POWER HOUSE CAVERN
PLAN AT EL1231.10
TURBINE FLOOR

NO.	REVISION OR ISSUES	DATE	BY.	CH.APP.
	ISSUED FOR TENDER			

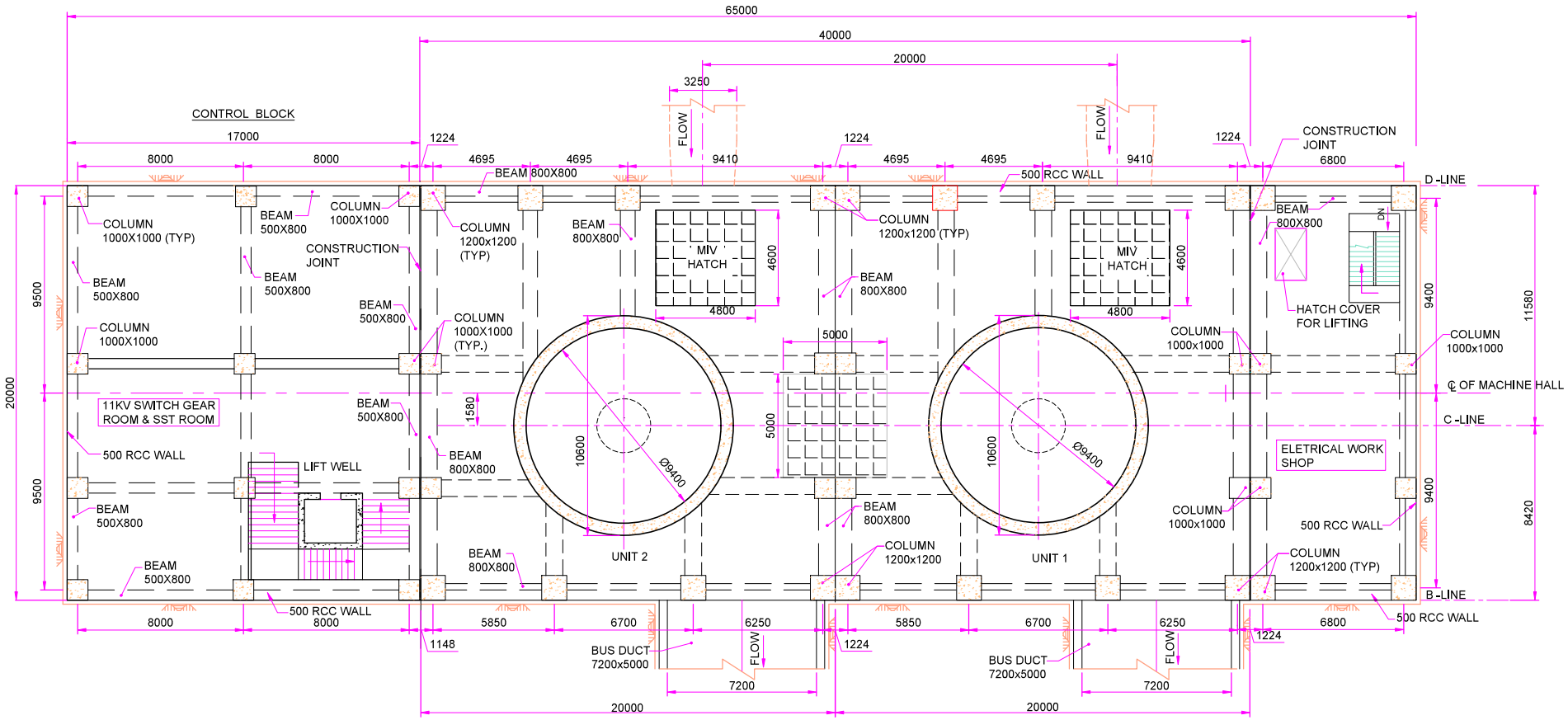
DESIGN MEMO NO.

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
S.TANWAR	S.TANWAR	VINOD.K	SAKET KUMAR

DATE MARCH,2025 | DRG. NO. NHUR-I(II) | 4CT1 | 41 | GA | 049 | 00

DRG. NO. NHUR-I(II)-4CT1 - 41 - GA - 049 - 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



TENDER DRAWING
NOT FOR CONSTRUCTION

PLAN AT EL 1235.10 (GENERATOR FLOOR)

0 2 4 6 8 10 M.

(SCALE 1:200)

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES ; LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAVE BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.
3. GRADE OF CONCRETE SHALL BE M25A40 AND FOR SECOND STAGE CONCRETE M35A20 CONFORMING TO SECTION B.5 OF TECHNICAL SPECIFICATION.

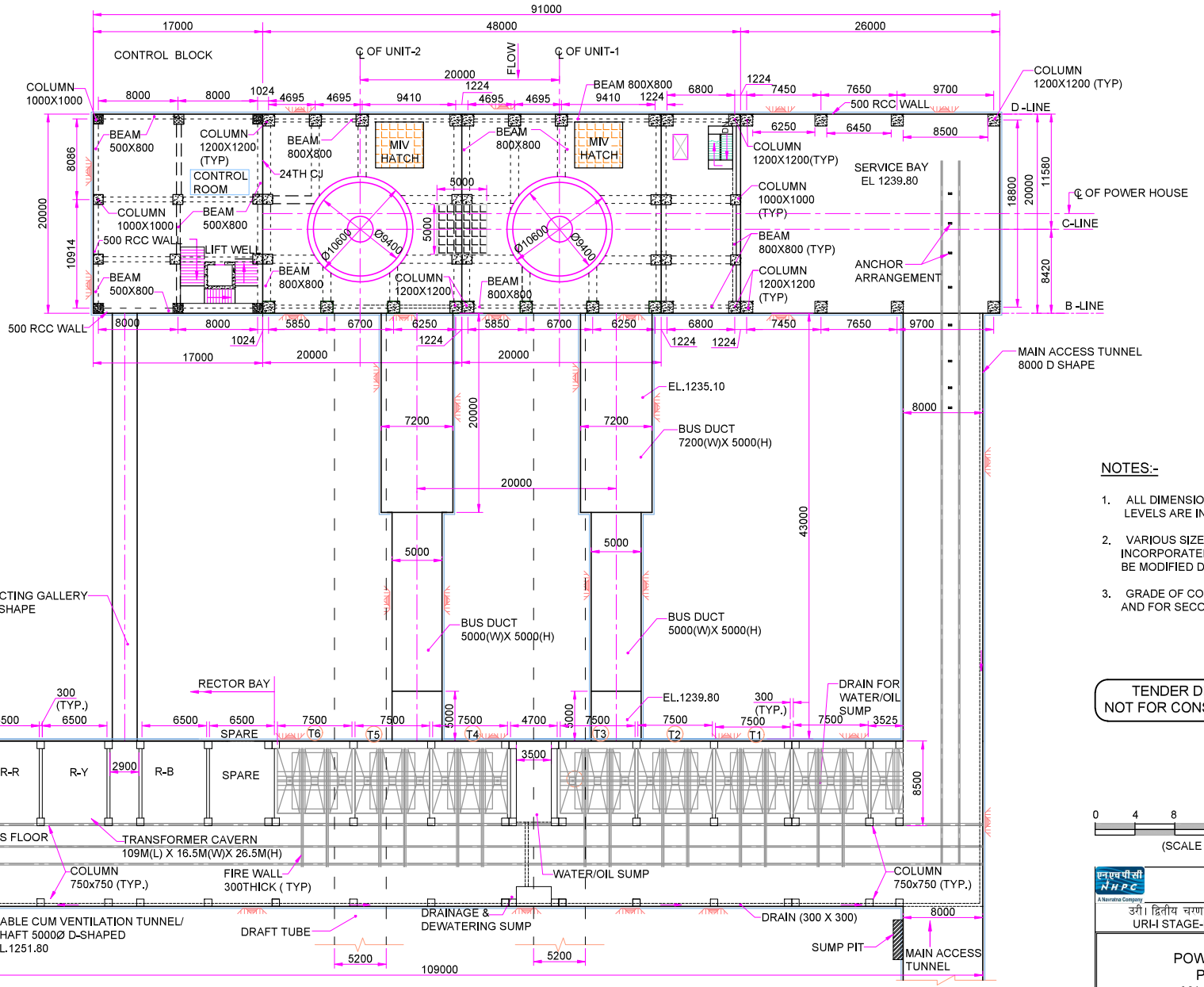
एन एच पी सी लिमिटेड
NHPC Limited
उरी। द्वितीय चरण जल विद्युत परियोजना (जम्मू एण्ड कश्मीर)
URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

POWER HOUSE CAVERN
PLAN AT EL1235.10
GENERATOR FLOOR

		ISSUED FOR TENDER								
DATE	NO.	REVISION OR ISSUES	BY.	CH.	APP.	DRAWN	SUBMITTED	RECOMMENDED		APPROVED
DESIGN MEMO NO.						S.TANWAR	S.TANWAR	VINOD.K		SAKET KUMAR
						DATE MARCH,2025	DRG. NO. NHUR-I(II)	4CT1	41	GA 050 00

DRG. NO. NHUR-I(II)-4CT1-41-GA-050-00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



PLAN AT MACHINE FLOOR LEVEL EL1239.80

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES AND LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAVE BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.
3. GRADE OF CONCRETE SHALL BE M25A40 AND FOR SECOND STAGE CONCRETE M35A20.

TENDER DRAWING
NOT FOR CONSTRUCTION

0 4 8 12 16 20 M.
(SCALE 1:400)

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उरी। द्वितीय चरण जल विद्युत परियोजना (जम्मू एण्ड कश्मीर)
URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

POWER HOUSE COMPLEX
PLAN AT EL 1239.80
MACHINE FLOOR LEVEL

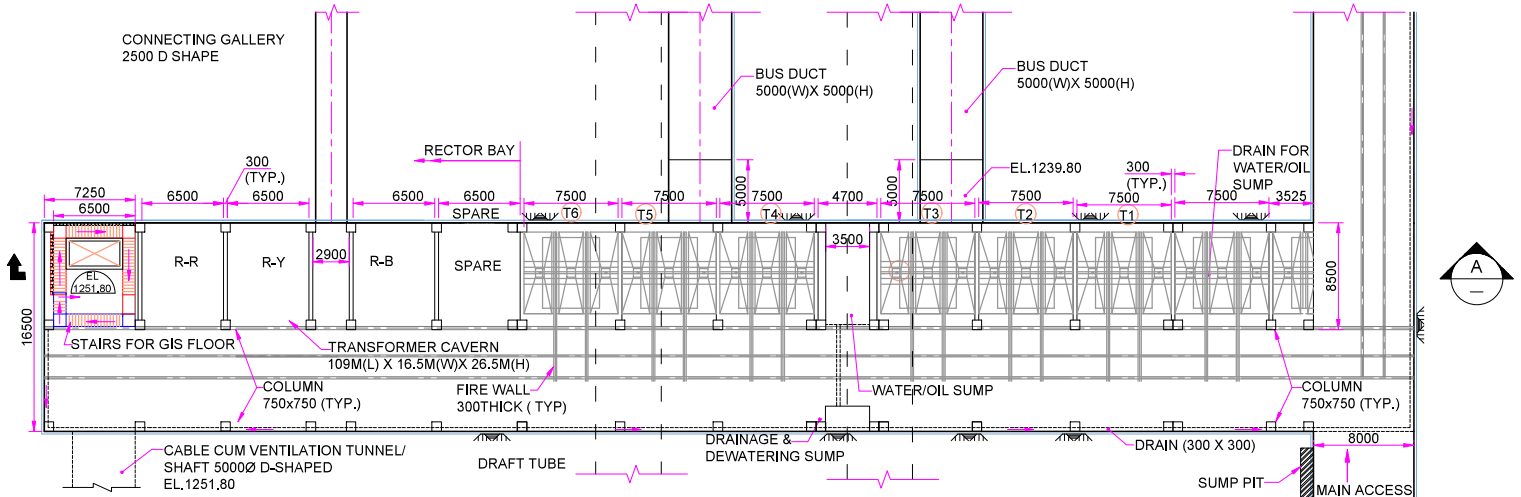
ISSUED FOR TENDER					
DATE	NO.	REVISION OR ISSUES	BY.	CH.	APP.

DESIGN MEMO NO.

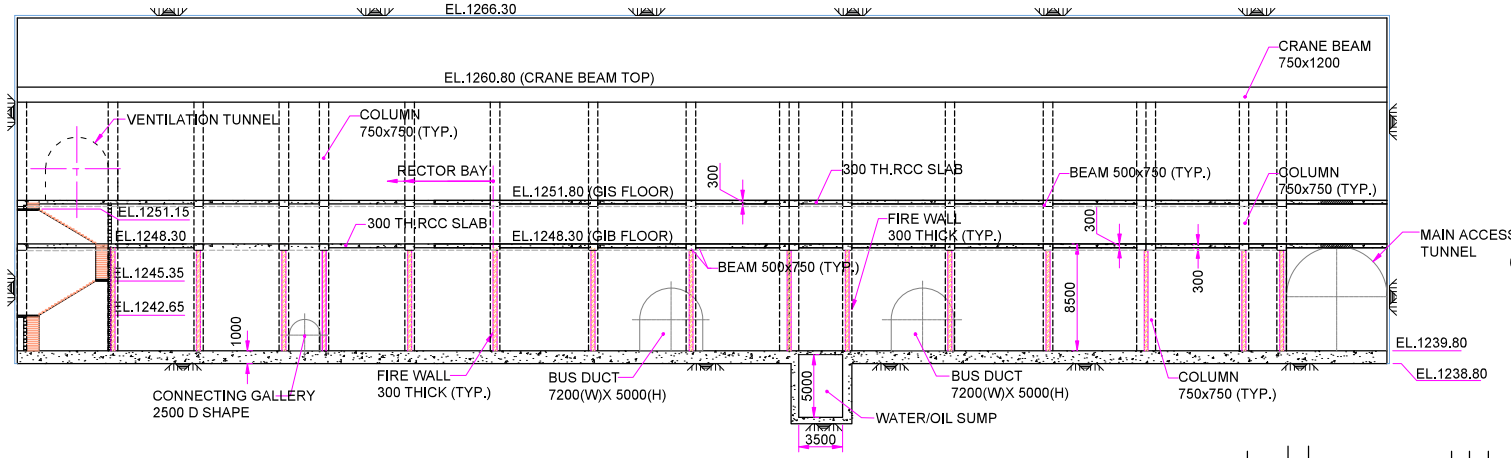
DRAWN	SUBMITTED	RECOMMENDED	APPROVED
S.TANWAR	S.TANWAR	VINOD.K	SAKET KUMAR

DATE: MARCH,2025 | DRG. NO.: NHUR-I(II) | 4CT1 | 41 | GA | 051 | 00

DRG. NO. NHUR-I(II)-4CT1-41-GA-051-00



PLAN AT LEVEL EL1239.80



SECTION

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES AND LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAVE BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.
3. GRADE OF CONCRETE SHALL BE M25A40 AND FOR SECOND STAGE CONCRETE M35A20.

TENDER DRAWING
NOT FOR CONSTRUCTION

0 4 8 12 16 20 M.
(SCALE 1:400)

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URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

TRANSFORMER CAVERN
PLAN AND SECTION

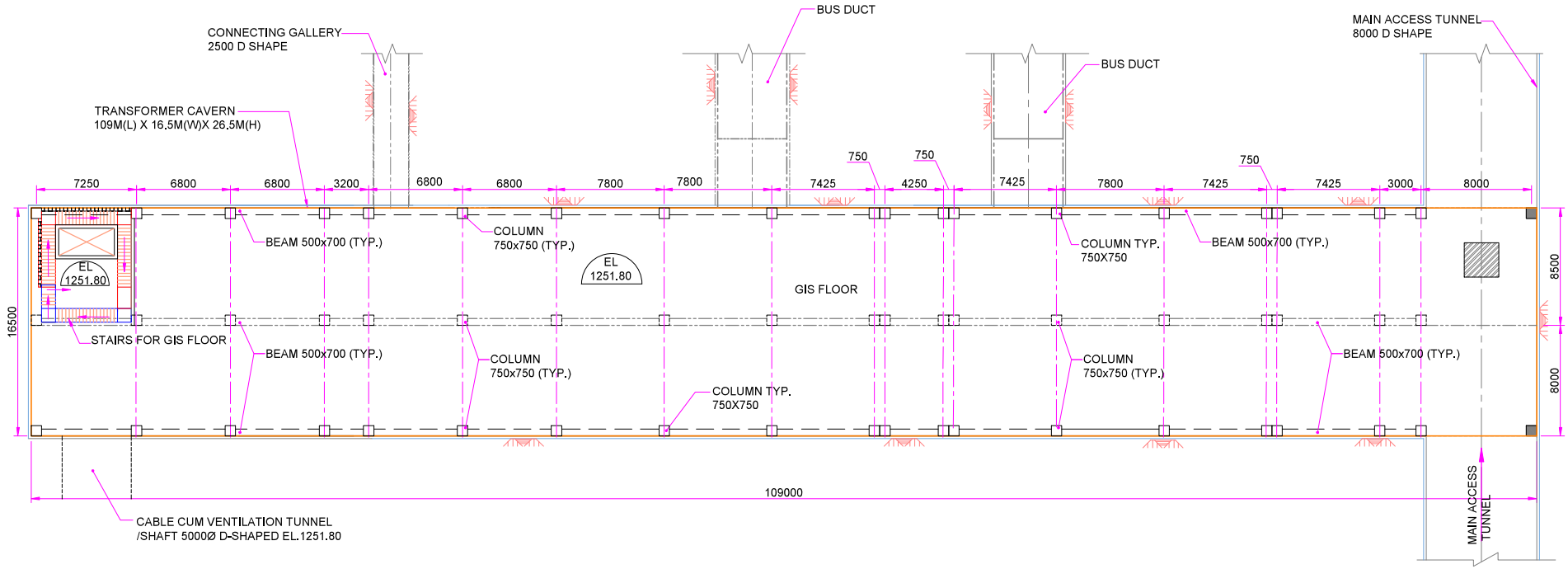
	NO.	REVISION OR ISSUES	BY.CH.APP.
		ISSUED FOR TENDER	

DESIGN MEMO NO.

DRAWN	SUBMITTED	RECOMMENDED		APPROVED
S.TANWAR	S.TANWAR	VINOD.K		SAKET KUMAR

DATE	DRG. NO.					
MARCH,2025	NHUR-I(II)	4GT1	41	GA	053	00

DRG. NO. NHUR-I(II)-4GT1 - 41 - GA - 053 - 00



PLAN AT EL1251.80

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES AND LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAVE BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.
3. GRADE OF CONCRETE SHALL BE M25A40 AND FOR SECOND STAGE CONCRETE M35A20.

TENDER DRAWING
NOT FOR CONSTRUCTION

0 3 6 9 12 15 M.

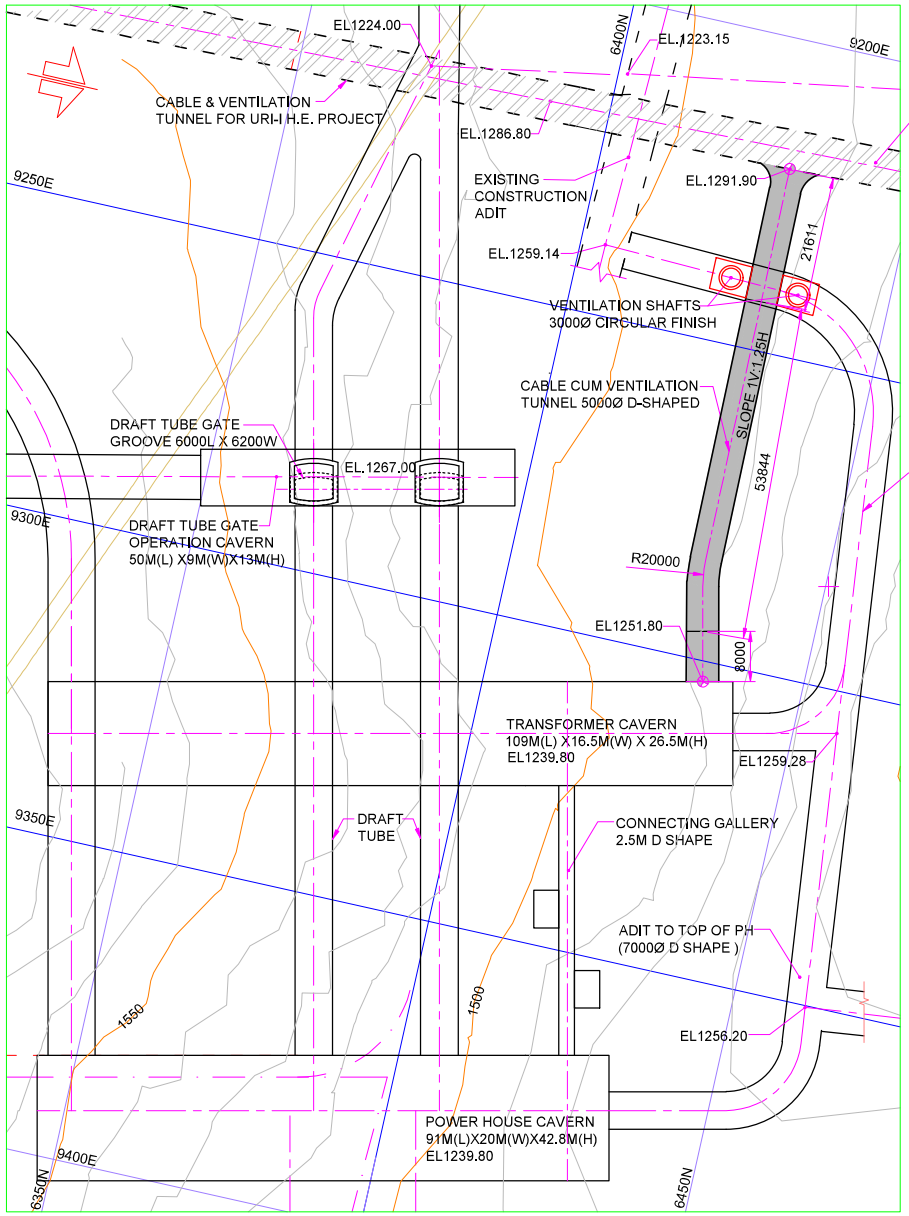
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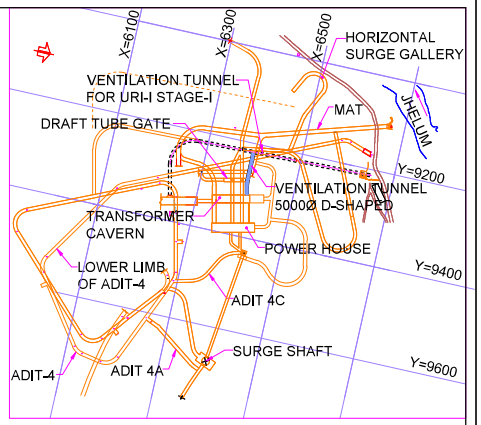
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URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

TRANSFORMER CAVERN
PLAN AT EL 1251.80 M (GIS FLOOR)

		ISSUED FOR TENDER			DRAWN	S.TANWAR	SUBMITTED	S.TANWAR	RECOMMENDED	VINOD.K		APPROVED	SAKET KUMAR	
DATE	NO.	REVISION OR ISSUES	BY.	CH.	APP	DATE	MARCH,2025	DRG. NO.	NHUR-I(II)	4CT1	41	GA	054	00
DESIGN MEMO NO.														

DRG. NO. NHUR-I(II)-4CT1 - 41 - GA - 054 - 00





KEY PLAN

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETERS ; LEVELS, AND GRID ARE IN METRES.
2. THIS DRAWING IS DEVELOPED BASED ON POWER HOUSE AREA SURVEY RECEIVED FROM PID VIDE E-IOM NO : NH/CO/PID/2021/443 DATED 10.08.2021 AND ADIT LOCATION VERIFIED BY PID E-IOM NH/CO/PID/2023/722 DATED 15.11.2023.
3. VARIOUS SIZE AND LEVELS HAS BEEN INCORPORATED IN THE DRAWING MAY BE MODIFIED DURING DETAILED DESIGN.
4. THE BLASTING SHALL BE DESIGNED BY THE CONTRACTOR FOR EXCAVATION OF ALL UNDERGROUND WORKS TO BE PERFORMED AND SHALL BE CONSTANTLY MONITORED CONSIDERING THE SAFETY OF THE EXISTING STRUCTURES OF URI-I H.E.PROJECT.

TENDER DRAWING
NOT FOR CONSTRUCTION

0 8 16 24 32 150 M.

(SCALE 1:800)

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URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

POWER HOUSE
CABLE CUM VENTILATION TUNNEL
PLAN

DATE	NO.	REVISION OR ISSUES	BY.	CH.	APP.
		ISSUED FOR TENDER			

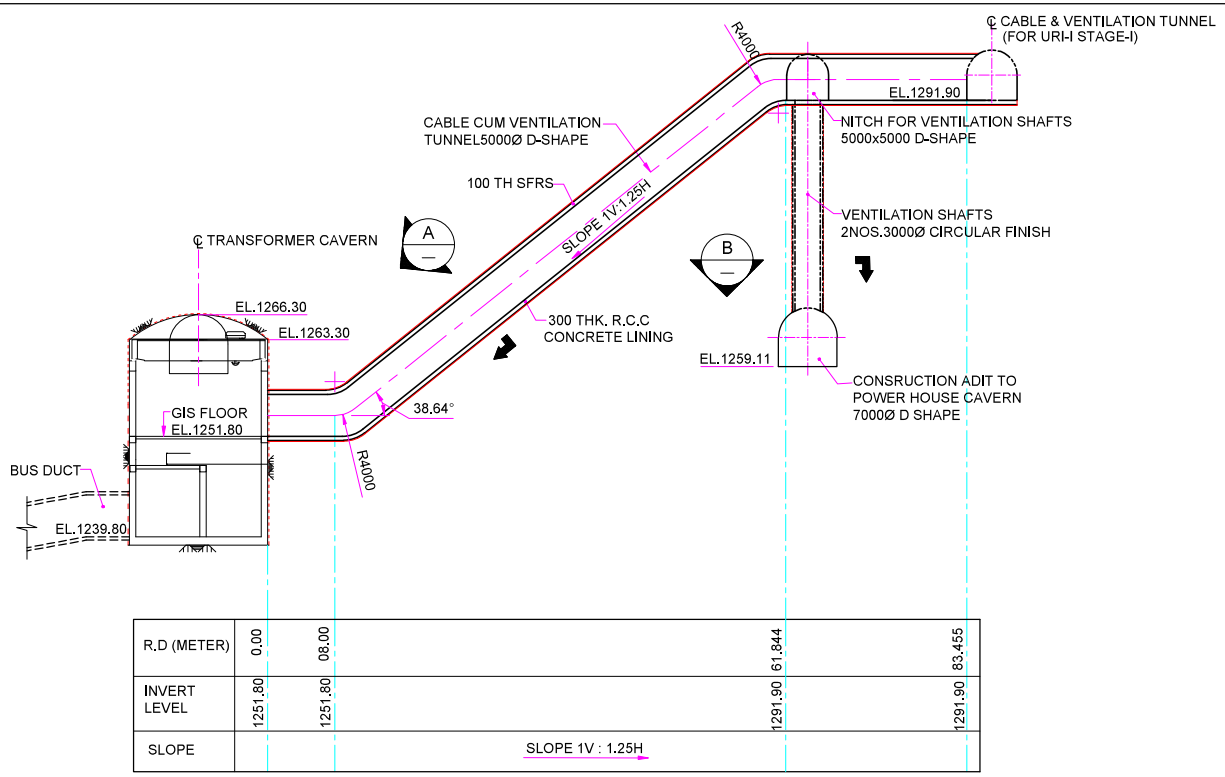
DESIGN MEMO NO.

DRAWN	SUBMITTED	RECOMMENDED		APPROVED
S.TANWAR	S.TANWAR	VINOD.K		SAKET KUMAR

DATE: MARCH,2025 | DRG. NO.: NHUR-I(II) | 4CT1 | 41 | GA | 063 | 00

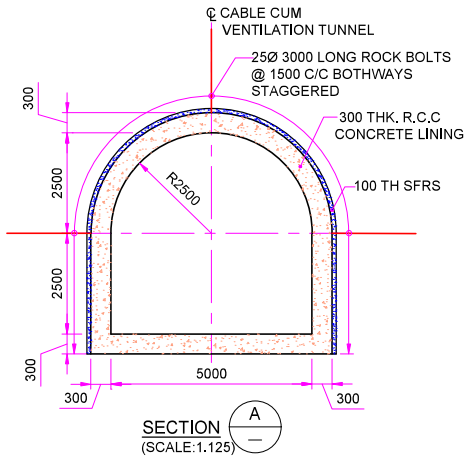
DRG. NO. NHUR-I(II) - 4CT1- 41 - GA - 063- 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016

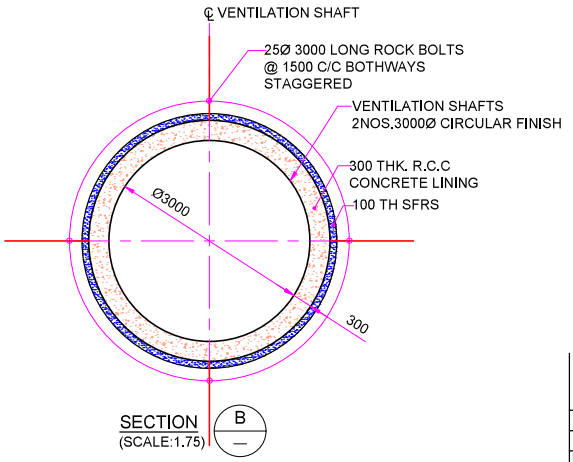


R.D (METER)	0.00	08.00	61.844	83.455
INVERT LEVEL	1251.80	1251.80	1291.90	1291.90
SLOPE	SLOPE 1V : 1.25H			

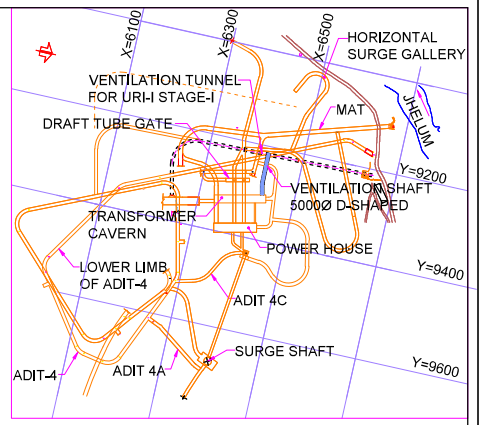
LONGITUDINAL SECTION THROUGH CENTER LINE OF VENTILATION SHAFT



SECTION A
(SCALE:1.125)



SECTION B
(SCALE:1.75)



KEY PLAN

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETERS ; LEVELS, AND GRID ARE IN METRES.
2. THIS DRAWING IS DEVELOPED BASED ON POWER HOUSE AREA SURVEY RECEIVED FROM PID VIDE E-IOM NO : NH/CO/PID/2021/443 DATED 10.08.2021
3. VARIOUS SIZE AND LEVELS HAS BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAILED DESIGN.
4. THE BLASTING SHALL BE DESIGNED BY THE CONTRACTOR FOR EXCAVATION OF ALL UNDERGROUND WORKS TO BE PERFORMED AND SHALL BE CONSTANTLY MONITORED CONSIDERING THE SAFETY OF THE EXISTING STRUCTURES OF URI-I H.E. PROJECT.

TENDER DRAWING
NOT FOR CONSTRUCTION

0 6 12 18 24 30 M.
(SCALE 1:600)

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URI-I STAGE-II HYDROELECTRIC PROJECT (J&K)

POWER HOUSE
CABLE CUM VENTILATION TUNNEL
SECTIONS

	NO.	REVISION OR ISSUES	BY.	CH.	APP.
		ISSUED FOR TENDER			

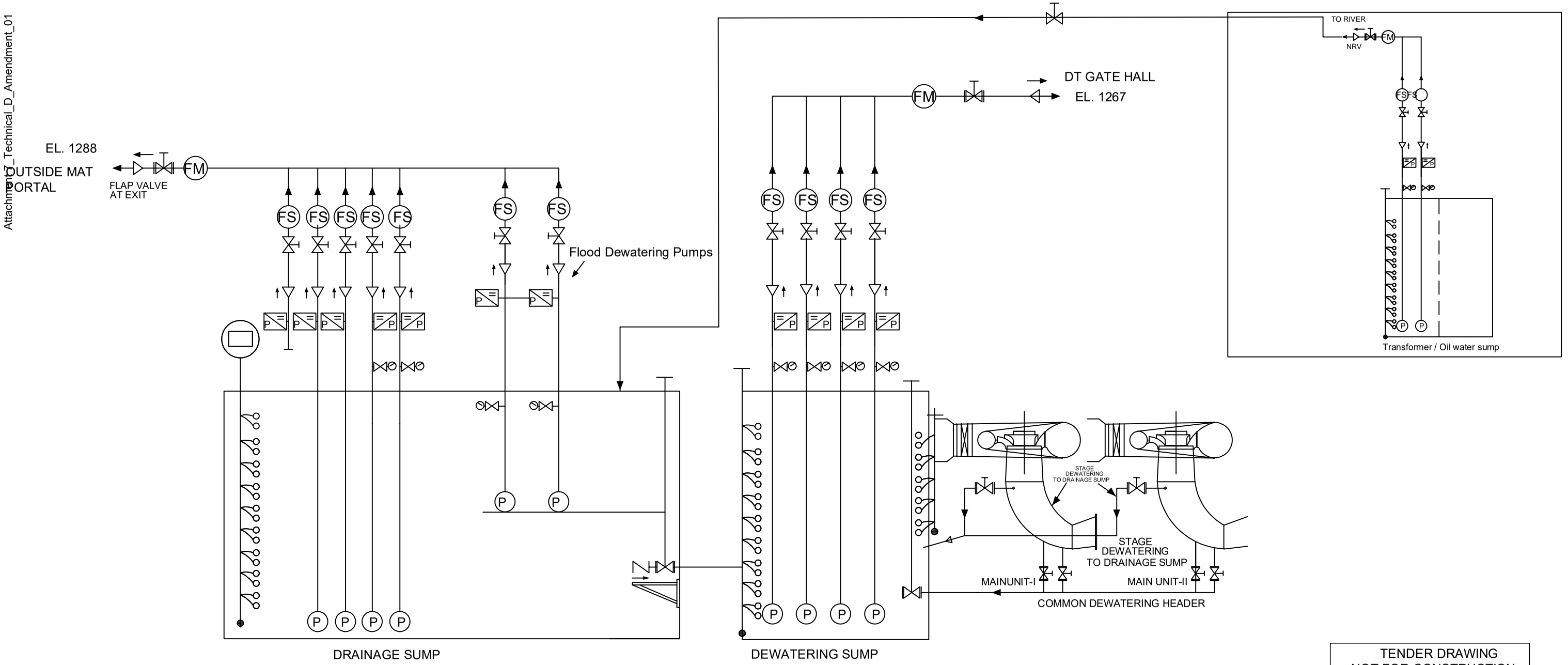
DESIGN MEMO NO.

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
S.TANWAR	S.TANWAR	VINOD.K	SAKET KUMAR

DATE MARCH,2025 | DRG. NO. | NHUR-I(II) | 4CT1 | 41 | GA | 064 | 00

DRG. NO. NHUR-I(II) - 4CT1- 41 - GA - 064 - 00

IMS/DED/F-02 REV. NO: 03 EFF. DATE : 21/07/2016



TENDER DRAWING
NOT FOR CONSTRUCTION

POWER HOUSE- DRAINAGE & DEWATERING SYSTEM

LEGEND :-

- NON- RETURN VALVE
- ISOLATING VALVE
- SUBMERSSIBLE PUMP-MOTOR
- GATE VALVE
- PRESSURE GAUGE
- FLOOD PUMP
- FLOW SWITCH
- FLOW METER
- LEVEL TRANSMITTER
- PRESSURE TRANSMITTER
- FLOAT SWITCH

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URI-I STAGE-II H E PROJECT

POWER HOUSE
DRAINAGE AND DEWATERING SYSTEM

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE JAN-25	DRG. NO.	NH/DEM/URI-ISTG-II/DD/01	

TO 400 kV AMARGARH SUBSTATION

400kV FEEDER -2

URI I POTHEAD YARD

400kV XLPE CABLE

SF6 TO AIR BUSHING

TO 400 kV AMARGARH SUBSTATION

URI I GIS

400kV FEEDER -1

TO Existing Uri PS 400kV GIS

400kV XLPE CABLE

400 KV BUS VT-1

CB-L1

LINE-2 BAY

DC-L11

DC-L12

LA

CB-L2

LINE-1 BAY

BUSBAR-1, 420 kV, 63kA, 1 sec , 4000 A

BUSBAR-2, 420kV, 63kA, 1 Sec, 4000 A

B/C BAY

CB-BC

400 KV BUS VT -II

CB-U1

UNIT-1 BAY

CB-U2

UNIT-2 BAY

BUS REACTOR BAY

OIL TO SF6 BUSHING (TYP.)

LA

GIB

GSU TR.
13.8/400 kV/√3
3X52 MVA,1Ø Bank

SC

SA

PT

PT

LAVT, METERING & PROTECTION

EXCIT. TRAF.

UTT

4000 KVA,3-Ø,
13.8/11 KV

G

120 MW + 10%
OVER LOADING,
13.8 KV,
0.85 PF,50 Hz

NGT

UNIT-1

UNIT-2

400 kV,1Ø,
3X26.67 MVAR

BUS REACTOR

LEGEND

- ISOLATOR
- CIRCUIT BREAKER
- CT
- V. T. / PT
- SURGE ARRESTOR
- EARTHING SWITCHEAR
- BUSHING CT
- DUCT CONNECTION
- ISOLATOR WITH EARTH SWITCH
- 400 kV GIL
- OIL TO SF6 BUSHING

TENDER DRAWING
NOT FOR CONSTRUCTION

NOTE:-

1. NO. AND RATINGS OF FEEDERS ARE INDICATIVE ONLY AND SHALL BE DECIDED DURING DETAIL ENGINEERING AFTER AWARD.

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URI-I STAGE-II H E PROJECT

MAIN SINGLE LINE DIAGRAM

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE JAN-25	DRG. NO.	NH/DEM/URI-I STG-II/SLD/01	

URI1 PS GIS

LINE 1

XLPE

URI 1 POT HEAD YARD

LINE 2

XLPE

(ALL THREE PHASE)

87B2

87B1

TO PMU

1000-1500-2000/1A

METERING SAME AS SHOWN FOR LINE NO.2

1000-1500-2000/1A

50Z 87 L FL

Voltage i/p from Bus PT

87L/21/78/67

59I/D

52 L2

25/27

S A

MAIN BUS -I. ,420 kV , 4000 A, 63 kA, 1 sec

I, V, kW,kVAR kWH,kVARH,PF,F

TO SCADA

Voltage i/p from CVT

MMIT CMIT

TO BE PROVIDED OTHERS

50Z 21/78/67 FL

59I/D

Voltage i/p from CVT

21/78/67

79

59I/D

25/27

52 L1

MAIN BUS -II 420 kV, 4000 A, 63 kA, 1 sec

PT FOR SYNCH.& METERING (ALL THREE PHASE)

SPARE

SPARE

52 G1

64 R

From Neutral side CT

87

From Neutral side CT

300-600-1000/1A

50Z 50/51

SMIT

87B1

87B2

52 G1

Spare

To PMU

50Z 50/51

SMIT

87B1

87B2

TO BE PROVIDED BY OTHERS

420 kV G.I.S

87 GT

64R

51NGT

FROM (SHT 2 OF 2)

GIB

400 kV,1Ø, 3X26.67 MVAR

TO 64 R

51N R

BUS REACTOR

87 GT

FROM (SHT 2 OF 2)

HV bushing CT 300/1 PS

64R

26T 49T 63 71T

(300/1A)

(300/1A)

GEN. TRANSFORMER-1
(NO. OF INCOMING GEN BAYS-2)

87B/ 87CH

87B, 87CH

SPARE

SPARE

50/51 50Z

1000-1500-2000/1A

52 BC1

BUS COUPLER

TO AUTO SYNCH. (IN ALL UNITS)

CT WIRES

UNIT#1
UNIT#2
LINE#2
B/C
LINE#1

NUMERICAL BUS BAR PROTECTION
87B
87CH

B/C LINE-2 UNIT-2 UNIT-1 LINE-1

BUS DISCONNECTOR POSITION

LEGEND:-

MMIT - MAIN METER FOR INTERFACE TARIFF
CMIT - CHECK METER FOR INTERFACE TARIFF
SMIT - STAND BY METER INTERFACE TARIFF

TENDER DRAWING
NOT FOR CONSTRUCTION

RATING OF CT/PT SHALL BE FINALIZED DURING DETAIL ENGINEERING

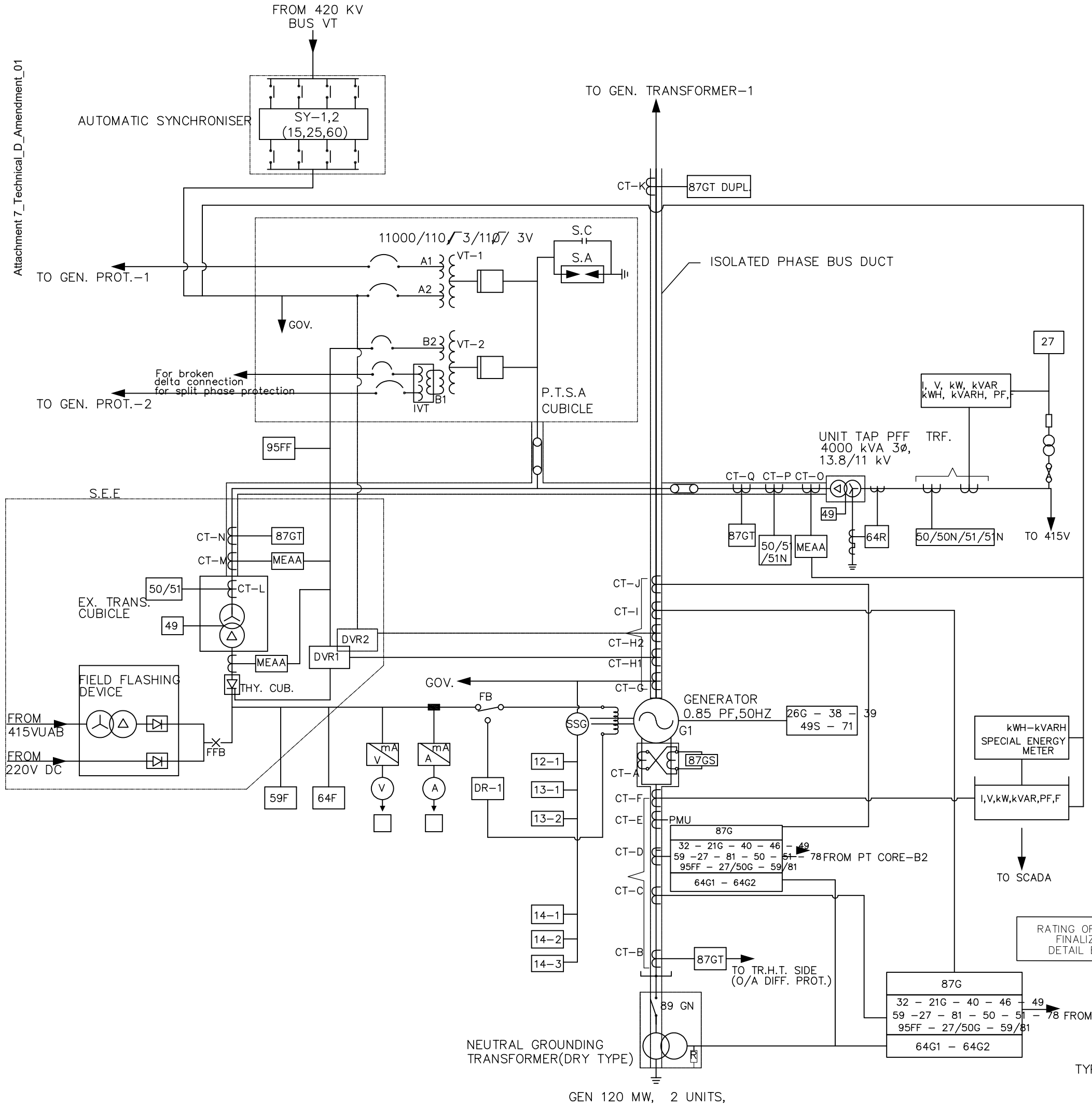
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URI-I STAGE-II H E PROJECT

PROTECTIVE RELAYING & METERING DIAGRAM

SHEET 1 OF 2

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE JAN-25	DRG. NO.	NH/DEM/URI-I STG-II /CP/01	



LEGEND :-

12	OVER SPEED RELAY
13	SPEED RELAY
14	UNDER SPEED RELAY
15	SPEED / FREQUENCY MATCHING RELAY
21	DISTANCE PROTECTION
21G	GEN.BACK–UP IMPEDANCE PROTECTION
25	CHECK SYNCHRONISING RELAY
26G	GEN. WDG. TEMP. ALARM & TRIP RELAY
26T	TR. OIL TEMP. ALARM & TRIP RELAY
27	UNDER VOLTAGE PROTECTION
27/50G	UNINTENTIONAL BACK ENERGISATION
32	REVERSE POWER PROTECTION
38	GEN. & TURBINE BEARING TEMP. ALARM & TRIP RELAY
39	GEN. VIBRATION ALARM & TRIP
40	LOSS OF FIELD PROTN.
46	NEGATIVE PHASE SEQUENCE PROTECTION
49	GEN. THERMAL PROTN.
49S	STATOR THERMAL OVER LOAD PROTN.
49T	TR. WDG. TEMP. ALARM & TRIP RELAY
50/51	INSTANTANEOUS & IDMT OVER CURRENT PROTECTION & E/F PROTECTION
50/51G	GEN.INSTANTANEOUS&IDMT OVER CURRENT PROTECTION
50/51/51N	INSTANTANEOUS & TIME DELAY OVER CURRENT & E/F PROTECTION
50Z	LOCAL BREAKER BACKUP PROTN.
51NGT	TRANSFORMER NEUTRAL OVER CURRENT PROTECTION
59F	FIELD OVER VOLTAGE PROTECTION
59G	GEN. OVER VOLTAGE INSTANTANEOUS & TIME DELAY PROTECTION
59 I/D	OVER VOLTAGE PROTN.(INSTANTANEOUS & TIME DELAY) OVER VOLTAGE
59/81	VOLT / HERTZ PROTECTION
60	VOLTAGE MATCHING RELAY
63	BUCHOLZ RELAY
64F	ROTOR(FIELD) EARTH FAULT PROTECTION
64G1&G2	100% & 95% STATOR EARTH FAULT PROTECTION
64R	GT RESTRICTED EARTH FAULT PROTECTION
67	DIRECTIONAL OVER CURRENT, E/F PROTECTION
71	GEN.& TURBINE BEARING OIL LEVEL ALARM & TRIP
71T	TRANSFORMER OIL LEVEL TRIP & ALARM
78	OUT OF STEP PROTECTION
79	AUTO RECLOSING RELAY
81	UNDER/OVER FREQUENCY PROTECTION
86B	TRIPPING RELAY
87B	BUS BAR DIFFERENTIAL PROTECTION –MAIN
87CH	BUS BAR DIFFERENTIAL PROTECTION –CHECK
87G	GEN. DIF. PROTECTION
87GS	SPLIT PHASE DIFF. PROTECTION
87GT	GEN. TRANSFORMER O/A DIFFERENTIAL PROTECTION
95	SUPERVISION RELAY
95FF	FUSE FAILURE PROTECTION/VOLTAGE BALANCE RELAY
97B1&B2	BUS PT FUSE FAILURE PROTN.
97L1&L2	LINE CVTFUSE FAILURE PROTN.
MEAA	METER FOR ENERGY ACCOUNTING & AUDIT
	SHAFT CURRENT PROTECTION

	SURGE ARRESTOR(S.A.)	mA	TRANSDUCER
	CIRCUIT BREAKER		COMPUTER SYSTEM
	CURRENT TRANSFORMER	PTSA	POTENTIAL TRANSFORMER & SURGE ARRESTOR
	VOLTAGE TRANSFORMER	SEE	STATIC EXCITATION EQUIPMENT
	SURGE CAPACITOR(S.C)	SSG	SPEED SIGNAL GENERATOR
	MCCB	DR–1	DISCHARGE RESISTOR
	SELECTOR SWITCH	FFB	FIELD FLASHING BREAKER
FB	FIELD BREAKER	DR–2	DISTURBANCE RECORDER
FL	FAULT LOCATOR	PLC	POWER LINE CARRIER
&	AND	LMU	LINE MATCHING UNIT
	FUSE	VS	VOLTAGE SELECTION RELAY

TENDER DRAWING
NOT FOR CONSTRUCTION

NOTE: –

1. THIS SINGLE LINE RELAYING & METERING DIAGRAM, UPTO LT. SIDE OF GEN. TRANSFORMER, IS SHOWN FOR "ONE" INCOMING BAY ONLY THE SCHEMATIC FOR THE REMAINING UNITS ARE IDENTICAL.

एन.एच.पी.सी NHPC एक नवरत्न कंपनी

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(भारत सरकार का एक नवरत्नउद्यम)
NHPC Limited
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URI-I STAGE-II H E PROJECT

PROTECTIVE RELAYING & METERING DIAGRAM
MAIN PLANT SHEET 2 OF 2

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE	DRG. NO.	NH/DEM/URI-ISTG-II/CP/01	
JAN-25			

BUS - I

BUS - II

PT FOR ALL THREE PHASES

BUS COUPLER

420kV GIS

GIB

BUS REACTOR

LINE-1

URI1 PS GIS

LINE-2

URI1 POT HEAD YARD

GSU TR.-1

GENERATOR-1

GSU TR.-2

GENERATOR-2

400 KV GIL

SF6 to AIR BUSHING

LEGEND:-

- 2 CORE VT
- SURGE ARRESTOR
- CIRCUIT BREAKER (52)
- HIGH SPEED GROUNDING SWITCH (57 M)
- SAFETY GROUNDING SWITCH (57M)
- CURRENT TRANSFORMER
- ISOLATOR (M 89)
- OIL to SF6 BUSHING

TENDER DRAWING
NOT FOR CONSTRUCTION

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(भारत सरकार का एक नवरत्न उद्यम)
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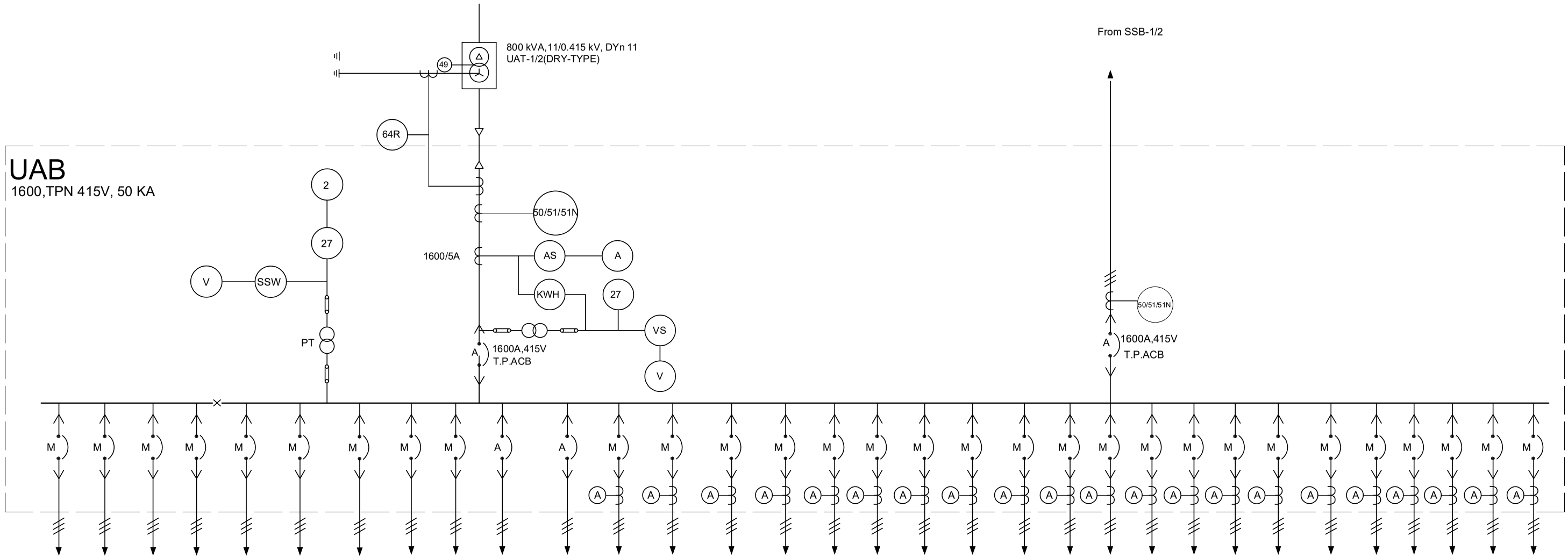
URI-I STAGE-II H E PROJECT

GENERAL SINGLE LINE DIAGRAM FOR GIS

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH

DATE JAN-25 | DRG. NO. NH/DEM/URI-I STG-II/SLD/02

Attachment 7_Technical_D_Amendment_01



FEEDER NO.																														
NAME OF FEEDER	EXCT. PANEL	FIELD FLASHING	UCB	TRF. PUMP-1	GEN. JACKING PUMP	SECONDARY COOLING PUMP - 1	SECONDARY COOLING PUMP - 2	LAMP & HEATER	TRF. PUMP-2	SPARE	SPARE	PR. CW PUMP-1	PR. CW PUMP-2	PR. CW STRAINER	PR. CW STRAINER	SPARE	SPARE	GREASE LUBR. PUMP	GOVERNOR OPU PUMP-1	GOVERNOR OPU PUMP-2	MIV OPU PUMP-1	MIV OPU PUMP-2	HP OIL LIFTING PUMP	BRAKE DUST COLL.	CARBON DUST COLL.	H. COVER DRAINAGE PUMP-1	H. COVER DRAINAGE PUMP-2	GOV. JOCKEY PUMP	MISC. BOARD-1	MISC. BOARD-2	SPARE	SPARE
LOCATION OF FEEDER																															
CONNECTED LOAD(KW)																															
MCCB RATING	32A	300A	32A	32A	32A	200A	200A	32A	32A	2500A ACB	2500A ACB	300A	300A	16A	16A	300A	300A	32A	64A	64A	300A	300A	32A	32A	32A	16A	16A	32A	16A	32A	64A	300A
CABLE SIZE & CABLE GLAND SIZE																															

	3Ø 415V,FEEDERS
A	415V AIR CIRCUIT BREAKER
M	415V MOULDED CASE CIRCUIT BREAKER
	CONNECTION THROUGH POWER CABLE

TENDER DRAWING
NOT FOR CONSTRUCTION

NOTE:-

1. NO. AND RATINGS OF FEEDERS ARE INDICATIVE ONLY AND SHALL BE DECIDED DURING DETAIL ENGINEERING AFTER AWARD.

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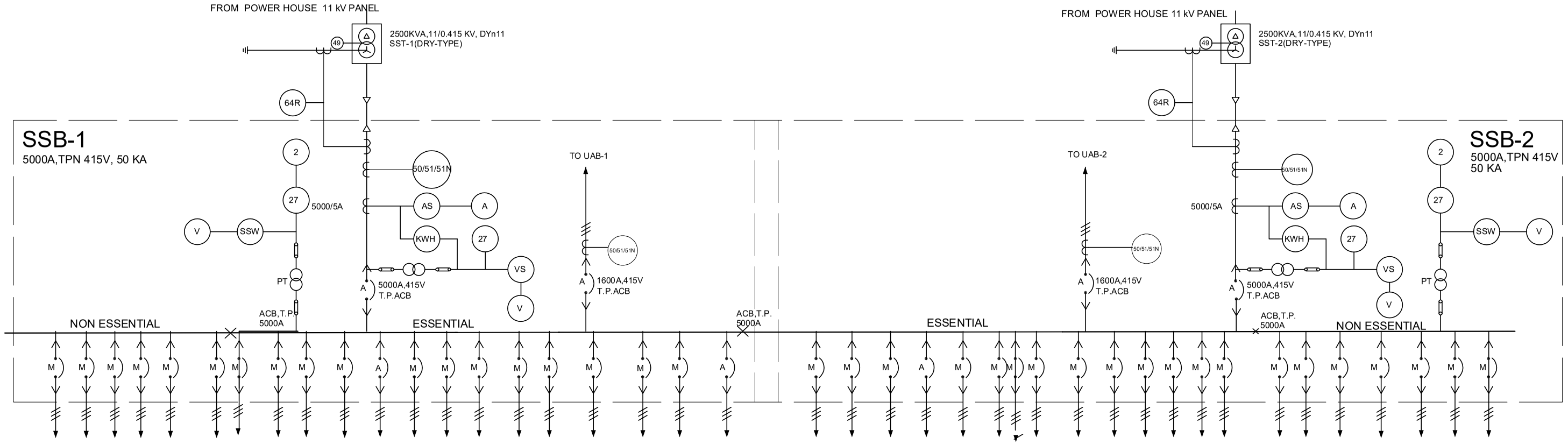
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URI-I STAGE-II H E PROJECT

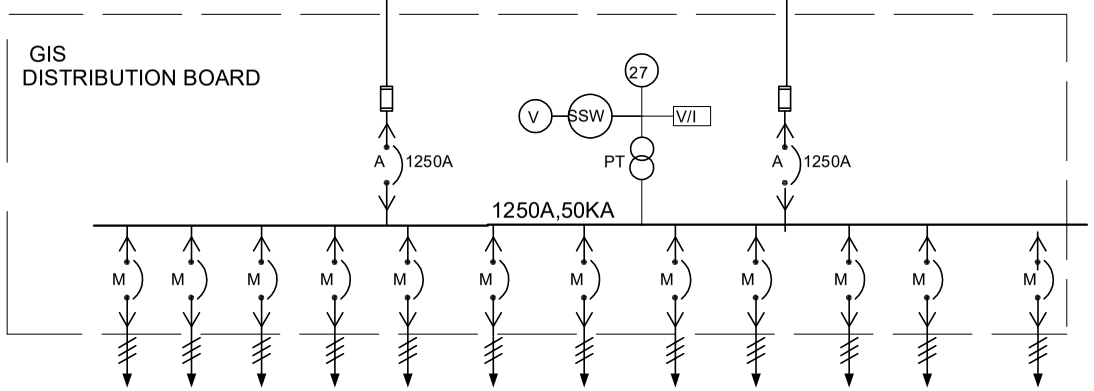
SINGLE LINE DIAGRAM
UNIT AUXILIARY BOARD

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE JAN-25	DRG. NO.	NH/DEM/URI-I STG-II/LT/01	

Attachment 7_Technical_D_Amendment_01



FEEDER NO.																																						
NAME OF FEEDER LOCATION OF FEEDER	MISC. BOARD-1	ELEC. TEST LAB	MECH. WORK SHOP	EOT CRANE-1	DEWAT. PUMP-1,2&3	V.T. DRAINAGE PUMP-3	INVERTER BYPASS ILLUMIN			DRAIN. PUMP-1,2&3	SPARE	220V DC BATTERY CHARGER-1	FIRE ALARM PANEL	L.P. COMP. BOARD1	SERVICE WATER SUPPLY-1		GIS DIST.BRD.	DRAFT TUBE GALLERY	B/DUCT ACV LCP	P/HOUSE ILLUMINATION BOARD - 1	SPARE	BUS COUPLER FROM SSB-1	HVAC	L.P. COMP. BOARD2	P/HOUSE ILLUMINATION BOARD - 2	SPARE	SPARE (2 Nos.)	VENT BOARD	INVERTER BYPASS	TR. CAVERN DIST.BRD.		SERVICE WATER SUPPLY-2	220V DC BATTERY CHARGER-2	DRAIN. PUMP-			FIRE PUMP (2 NO.)	HVAC PUMP	DEWAT. PUMP-	DRAINAGE	MISC. BOARD-2	EOT CRANE-2	ELEVATOR
CONNECTED LOAD(KW)																																							
MCCB RATING	200A	200A	63A	300A	200A	63A	200A	63A		400A	1600A ACB	200A	200A	63A	100A	200A	630A	200A	100A	400A	2500A ACB	5000A T.P.ACB	250A	63A	400A	5000A ACB	100A/200A	200A	100A	630A	200A	100A	200A	400A	63A		63A	100A	200A	63A	200A	300A	63A
CABLE SIZE & CABLE GLAND SIZE																																							



FEEDER NO.												
NAME OF FEEDER LOCATION OF FEEDER	OIL FILT-RATION PUMP	SERVICE OUTLET	OIL WATER SAPERATOR PUMP-1	CRANE	OIL WATER SAPERATOR PUMP-2	DRAINAGE PUMP-1 (TR.CAVERN)	DRAINAGE PUMP-2 (TR.CAVERN)	TRF. LIGHTING-1	TRF. LIGHTING-2	GIS ACV LCP	GIS LIGHT. PANEL SOURCE-1	GIS LIGHT. PANEL SOURCE-2
CONNECTED LOAD(KW)												
MCCB RATING	32A	64A	64A	32A	64A	64A	64A	100A	100A	125A	100A	100A
CABLE SIZE & CABLE GLAND SIZE												

TENDER DRAWING
NOT FOR CONSTRUCTION

	3Ø 415V,FEEDERS
A	415V AIR CIRCUIT BREAKER
M	415V MOULDED CASE CIRCUIT BREAKER
	CONNECTION THROUGH POWER CABLE

NOTES:-

1. NO. AND RATINGS OF FEEDERS ARE INDICATIVE ONLY AND SHALL BE DECIDED DURING DETAIL ENGINEERING, AFTER AWARD.
2. ALL THE LOADS (ESSENTIAL & NON ESSENTIAL) SHOWN IN THE DRAWING ARE TENTATIVE SHALL BE MODIFIED IN ACCORDANCE TO ACTUAL REQUIREMENT.

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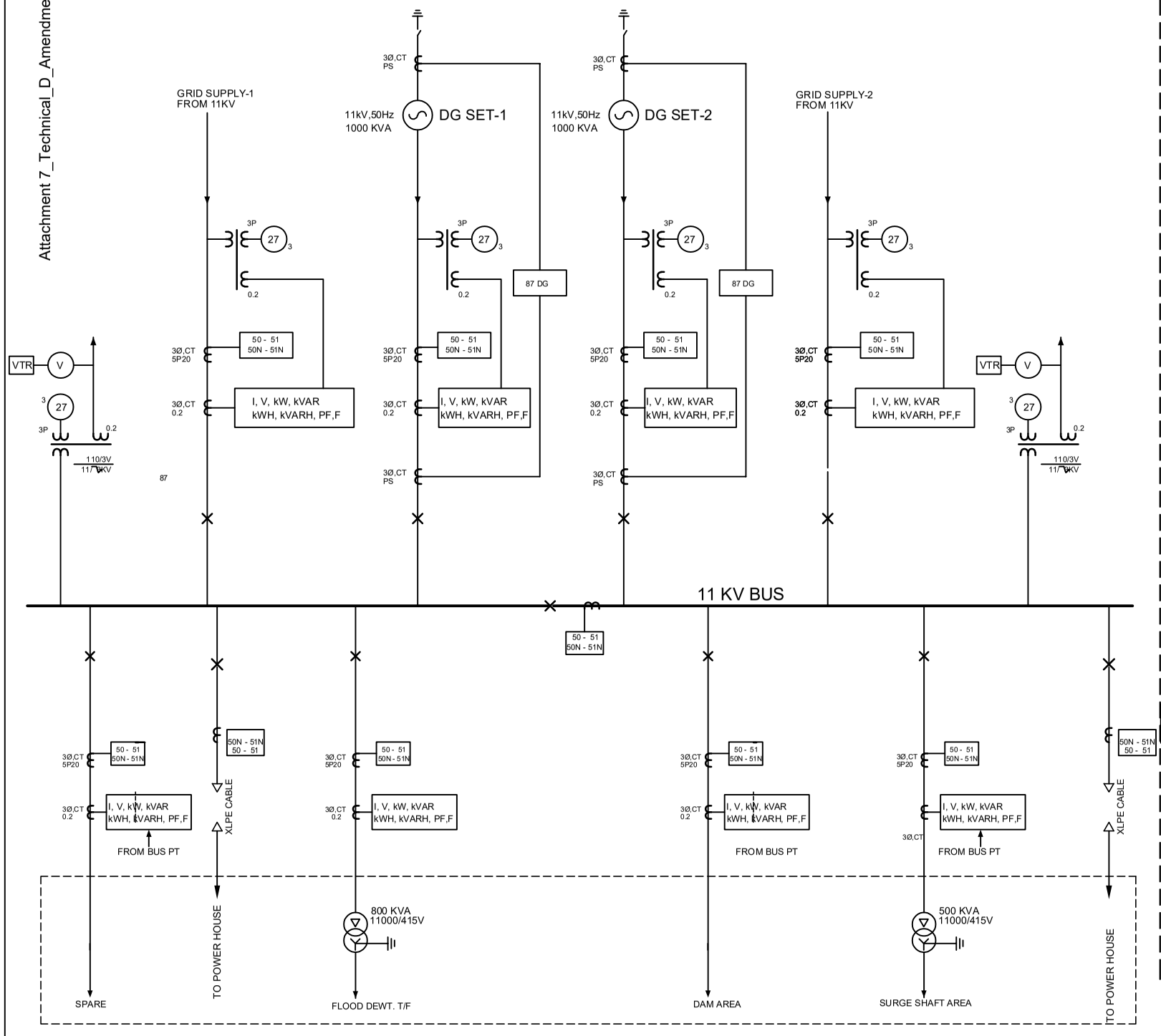
URI-I STAGE-II H E PROJECT

SINGLE LINE DIAGRAM
STATION SERVICE BOARD

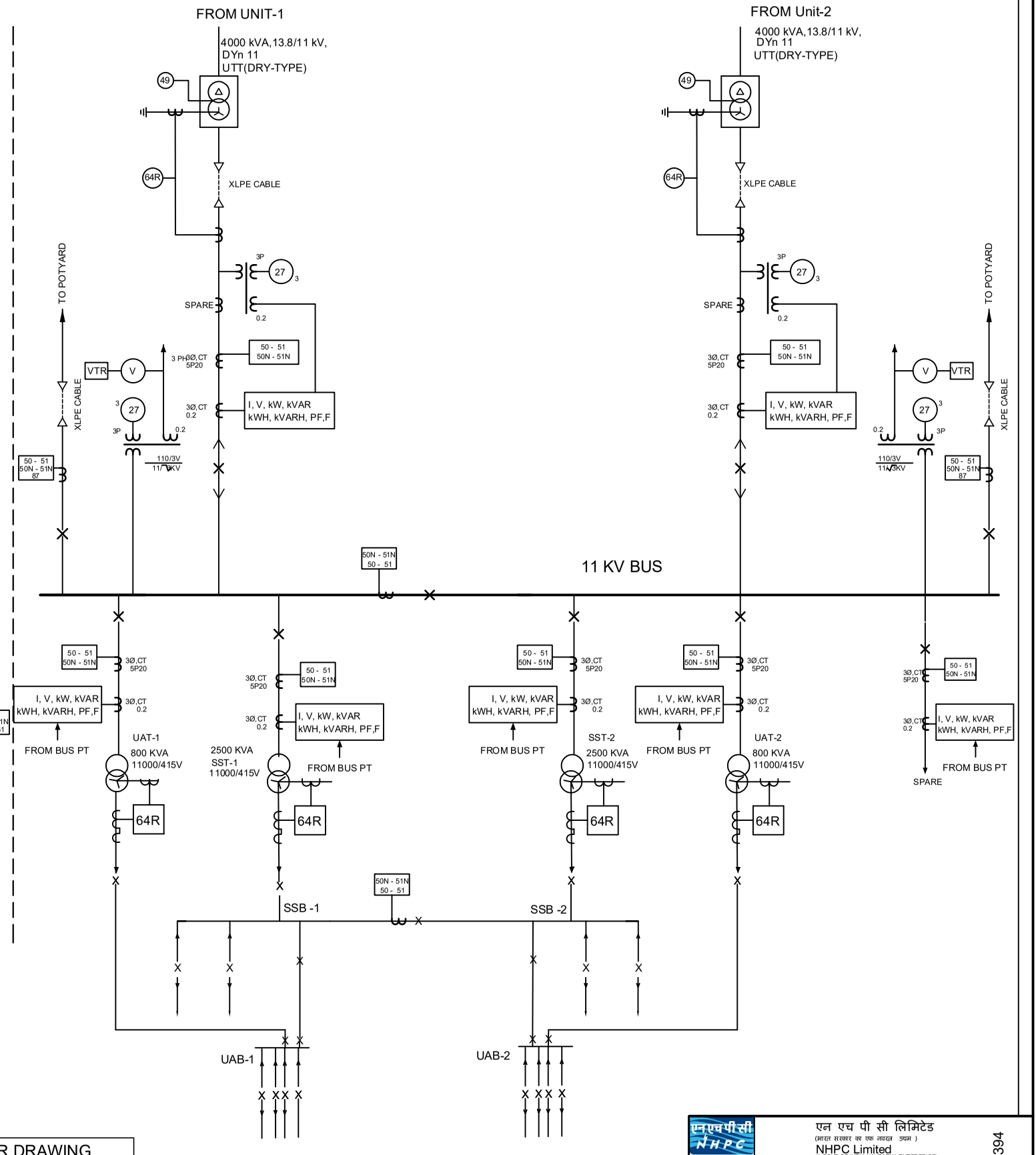
DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE JAN-25	DRG. NO.	NH/DEM/URI-I STG-II/LT/02	

Attachment 7_Technical_D_Amendment_01

POTYARD 11kV SYSTEM



POWER HOUSE 11KV SYSTEM



TENDER DRAWING

NOTE:-

1. NO. AND RATINGS OF FEEDERS ARE INDICATIVE ONLY AND SHALL BE DECIDED DURING DETAIL ENGINEERING AFTER AWARD.

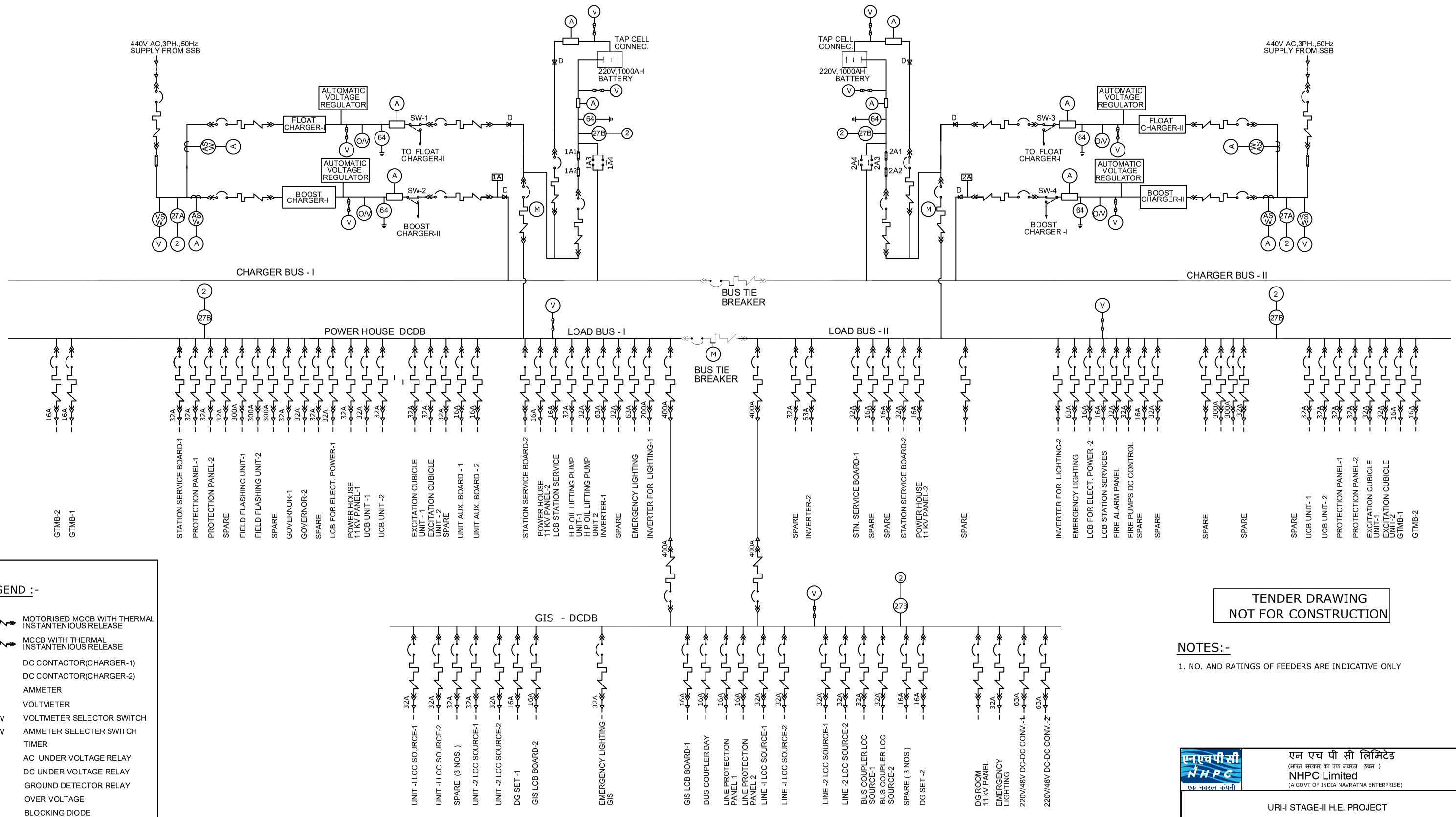
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URI-I STAGE-II H E PROJECT

SINGLE LINE DIAGRAM
MV SWITCHGEAR AND
AUXILARY TRANSFORMER

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N.K. SINGH
DATE	DRG. NO	NH/DEM/URI-I STG-II/CP/05/00	
APRIL-25			

Attachment 7_Technical_D_Amendment_01



LEGEND :-

	MOTORISED MCCB WITH THERMAL INSTANTENIOUS RELEASE
	MCCB WITH THERMAL INSTANTENIOUS RELEASE
1A	DC CONTACTOR(CHARGER-1)
2A	DC CONTACTOR(CHARGER-2)
A	AMMETER
V	VOLTMETER
VSW	VOLTMETER SELECTOR SWITCH
ASW	AMMETER SELECTER SWITCH
2	TIMER
27A	AC UNDER VOLTAGE RELAY
27B	DC UNDER VOLTAGE RELAY
64	GROUND DETECTOR RELAY
O/V	OVER VOLTAGE
	BLOCKING DIODE
	AMMETER WITH SHUNT
SW-1, 2, 3, 4	CHANGE OVER SWITCH

TENDER DRAWING
NOT FOR CONSTRUCTION

NOTES:-

1. NO. AND RATINGS OF FEEDERS ARE INDICATIVE ONLY

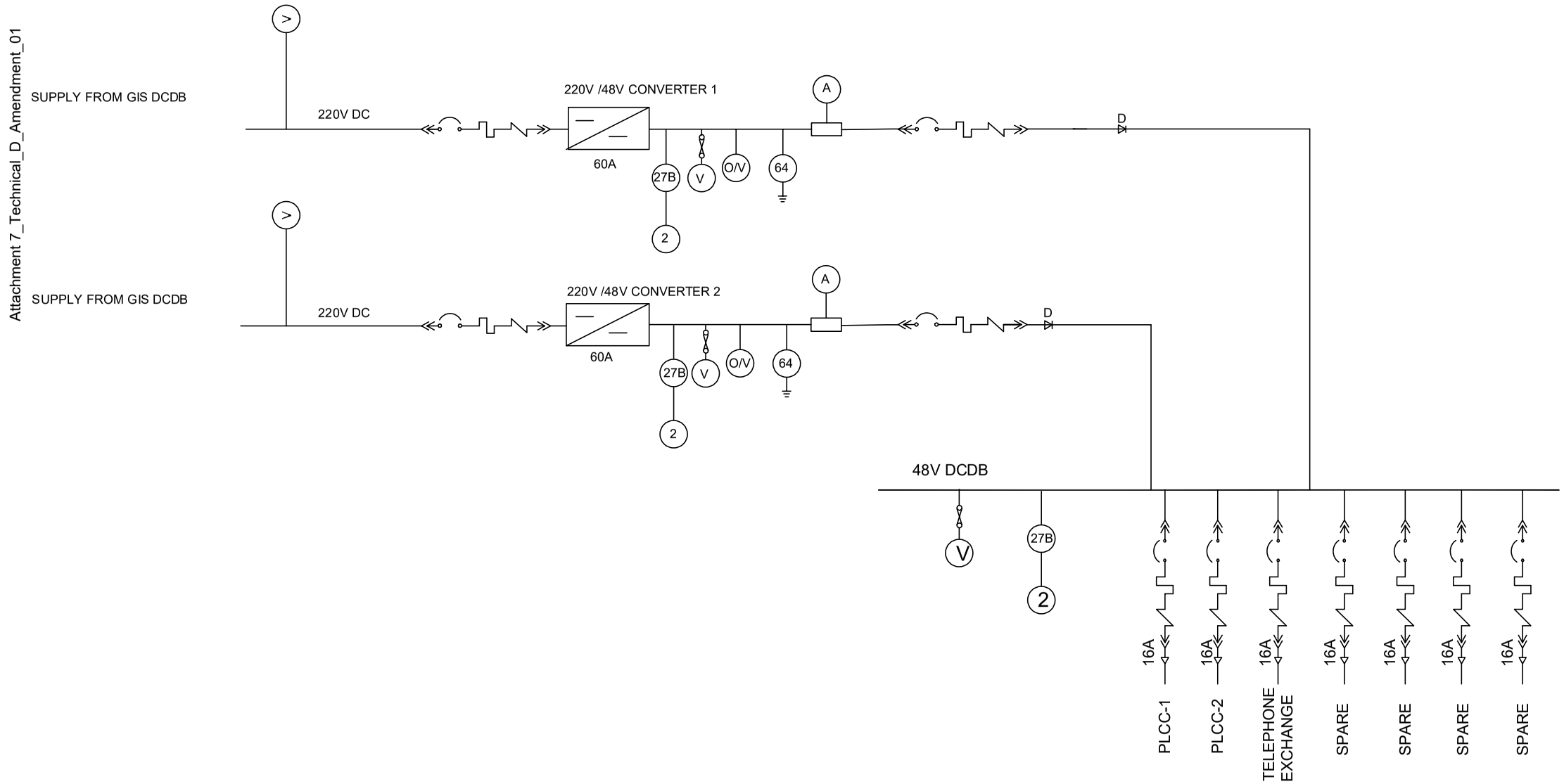
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URI-I STAGE-II H.E. PROJECT

SINGLE LINE DIAGRAM
220V DC STATION SERVICE

SH. 1 OF 2

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N.K. SINGH
DATE	DWG. NO.	NH/DEM/URI-I STG-II/DC/01	REV. NO.
JAN-25			



NOTE:-

1. NO. AND RATING OF FEEDERS ARE INDICATIVE ONLY AND SHALL BE FINALISED DURING DETAILED ENGINEERING,AFTER AWARD

LEGEND:-

	MCCB WITH THERMAL INSTANTENIOUS RELEASE	2 TIMER
V	VOLTMETER	27B 48V DC UNDER VOLTAGE RELAY
		64 GROUND DETECTOR RELAY
		O/V OVER VOLTAGE
		BLOCKING DIODE
A		AMMETER WITH SHUNT

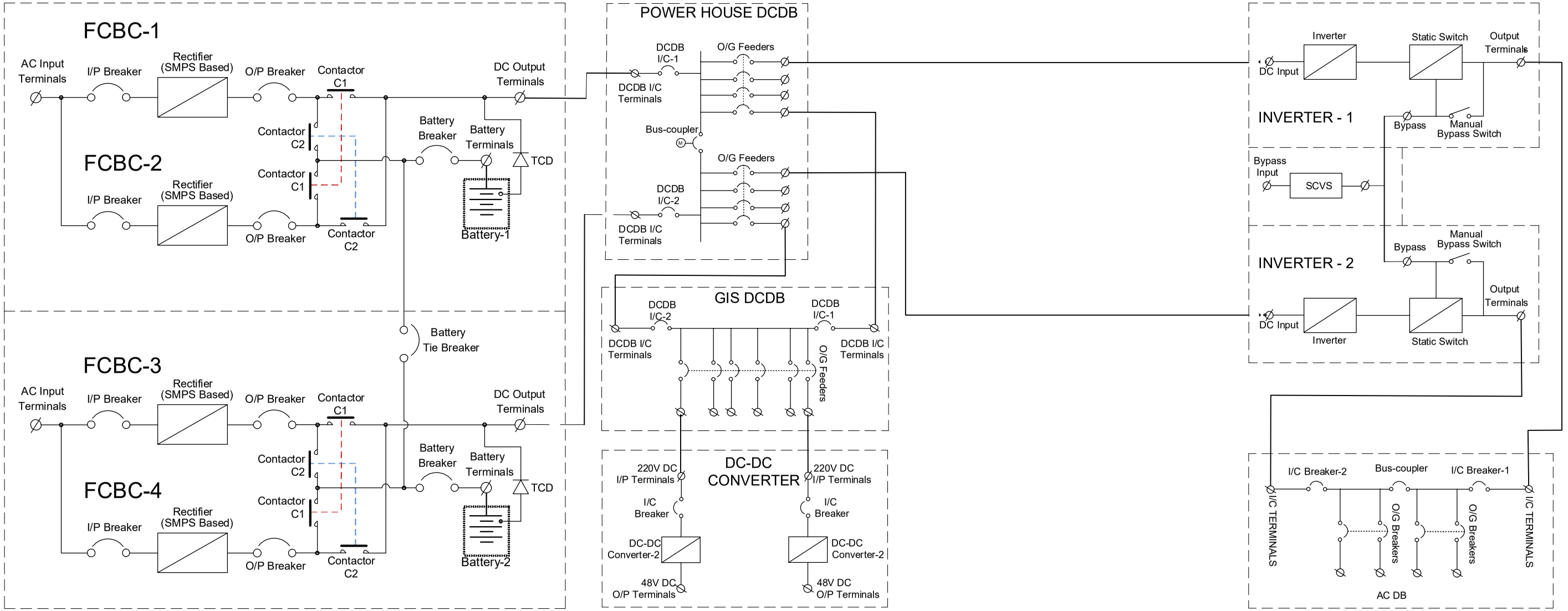
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URI I STG-II H.E. PROJECT

220 V DC SYSTEM

SH. 2 OF 2

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	PRANAV KUMAR	P C SHARMA	N K SINGH
DATE: JUN-2025	DRG. NO.	NH/DEM/URI-I STG-II/DC/01	



NOTE:-

1. TENTATIVE DETAILS OF DC DISTRIBUTION FEEDER CAN BE REFER FROM DWG. NO. NH/DEM/URI-I STG-II/DC/01

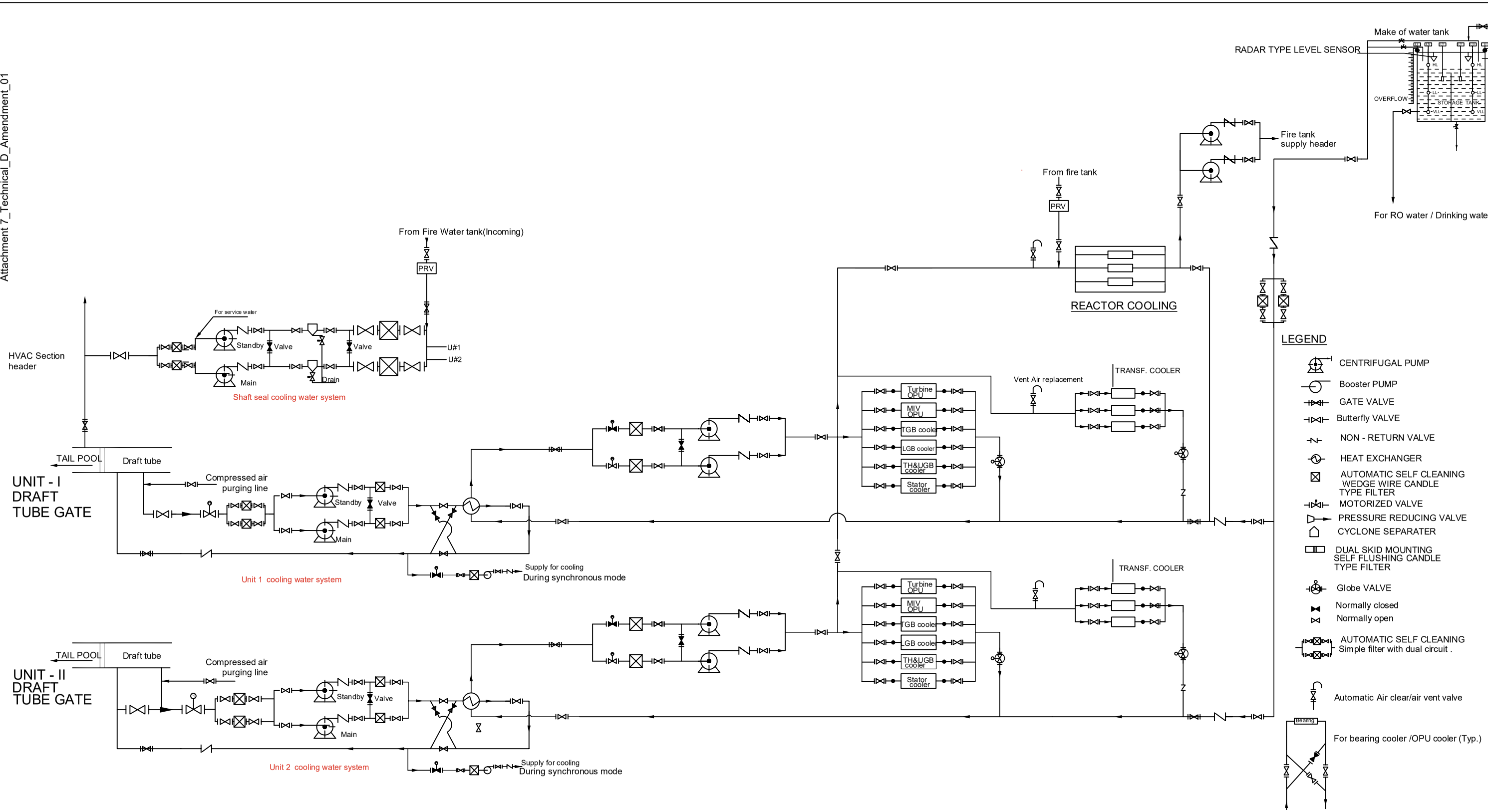
TENDER DRAWING
NOT FOR CONSTRUCTION

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URI I STG-II H.E. PROJECT

220 V DC SYSTEM

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	PRANAV KUMAR	P C SHARMA	N K SINGH
DATE: JUN-2025	DRG. NO.	NH/DEM/URI-I STG-II/DC/02	



COOLING WATER SYSTEM

NOTES

1. Intrumentation HAVE NOT BEEN SHOWN IN THE DRG. HOWEVER, THE SAME SHALL BE SUPPLIED IN LINE WITH TECH. SPEC.
2. BACK FLUSHING ARRANGEMENT TO BE FINALISED DURING DETAILED ENGINEERING.
3. INSTRUMENTATION SHALL BE PROVIDED WITH ISOLATING VALVE
4. TYPE OF VALVES ARE INDICATIVE ONLY AND SHALL BE FINALISED DURING DETAILED ENGINEERING.

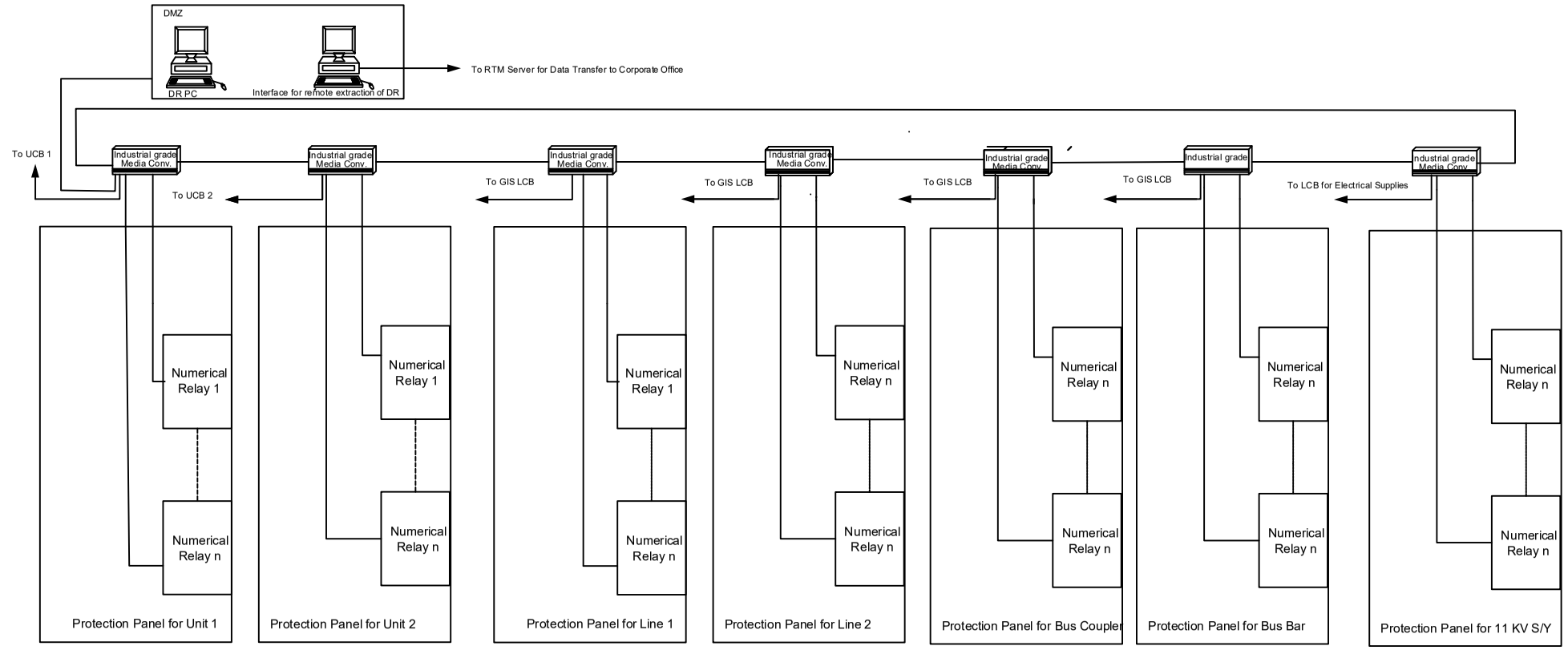
TENDER DRAWING
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URI-I STAGE-II H E PROJECT

SINGLE LINE DIAGRAM FOR COOLING WATER SYSTEM

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE	DRG. NO.		
JAN-25	NH/DEM/URI-ISTG-II/CW/01		



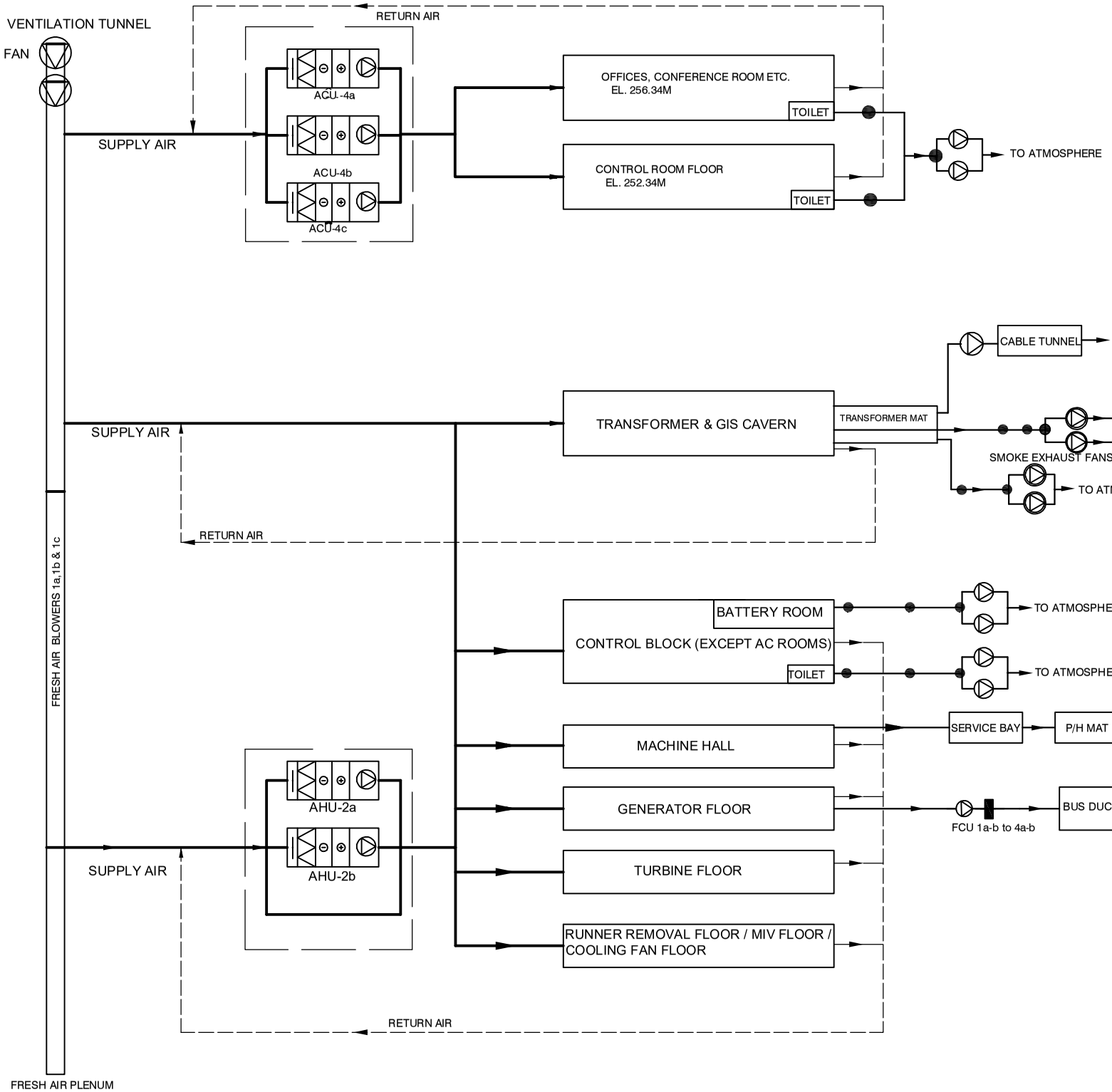
TENDER DRAWING
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URI-I STAGE-II H E PROJECT

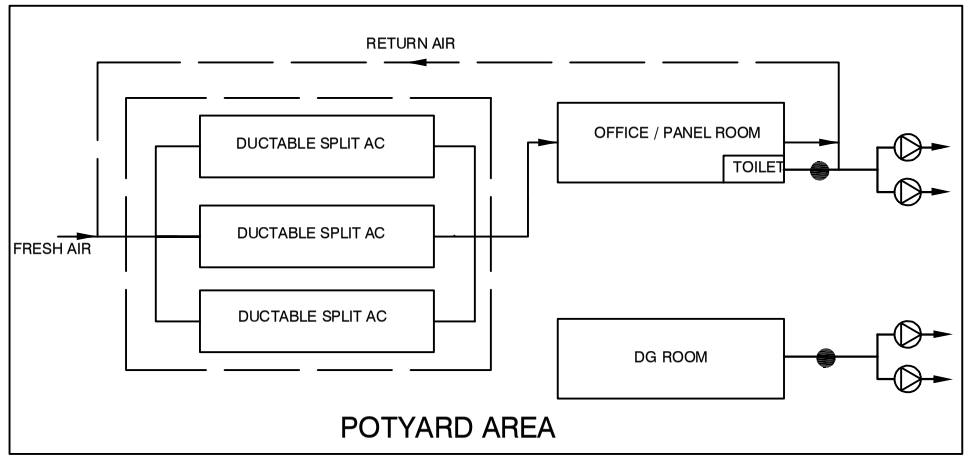
PROTECTION RELAY NETWORK

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE	DRG. NO.	NH/DEM/URI-ISTG-II/RELAY NW#01	
JAN-25			



LEGENDS :-

- SUPPLY AIR DUCT
- RETURN AIR DUCT
- EXHAUST TO ATMOSPHERE
- EXHAUST FAN
- FAN COIL UNIT
- SUPPLY AIR FAN
- AIR/SMOKE EXHAUST FAN



NOTES : -

1. AIR FLOW PATH SHOWN IS INDICATIVE ONLY AND SHALL BE FINALISED DURING DETAIL ENGINEERING .
2. NUMBER OF EXHAUST FANS ARE INDICATIVE ONLY AND SHALL BE FINALISED DURING DETAIL ENGINEERING .

TENDER DRAWING
NOT FOR CONSTRUCTION

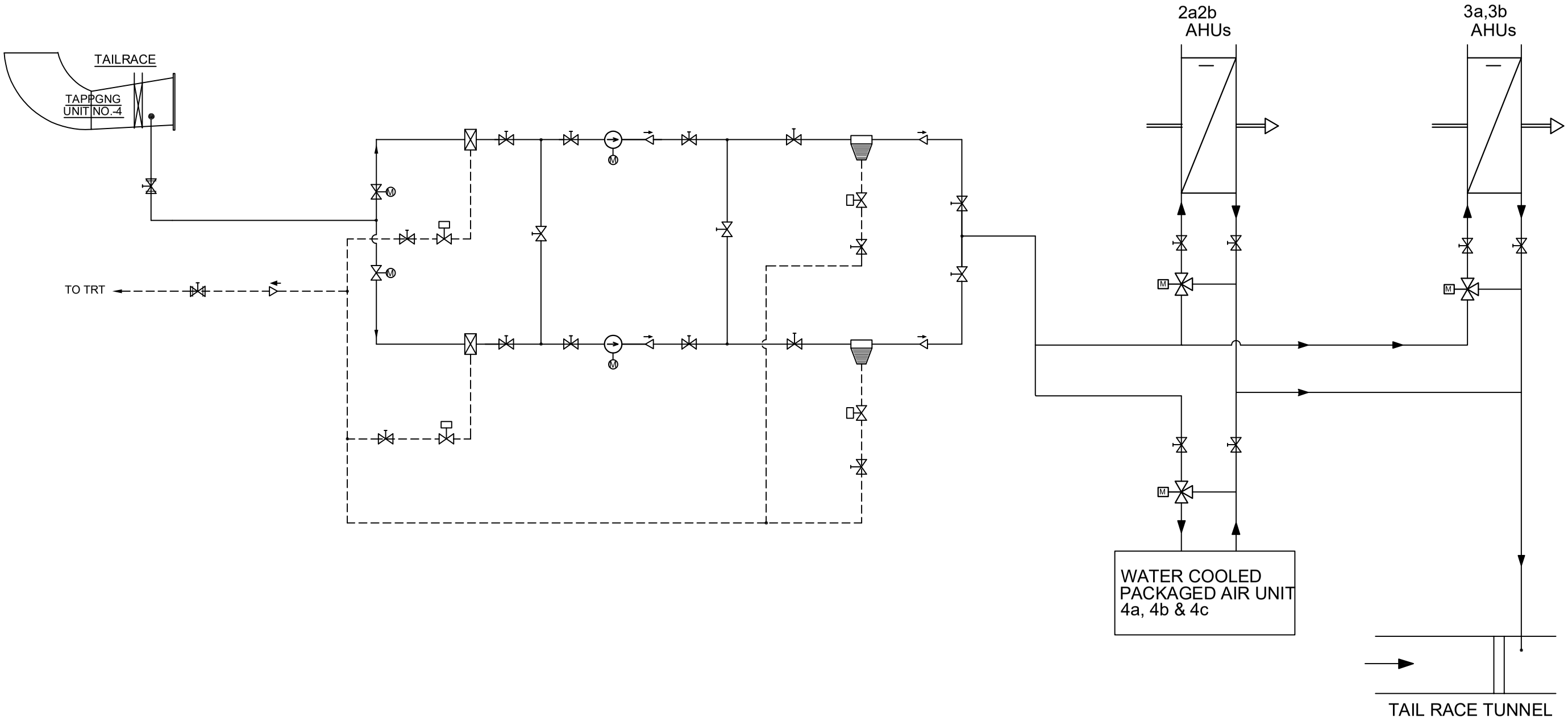
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URI-I STAGE-II H.E. PROJECT

HVAC SYSTEM AIR FLOW DIAGRAM

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N.K. SINGH

DATE	DRG. NO.		REV. NO.
MAY-25		NH/DEM/URI-I STG-II/AC/01	



LEGEND:-

MOTORIZED VALVE WITH MANUAL OVERIDE	CYCLONE FILTER
GATE VALVE	MOTORIZED THREE WAY VALVE
NORMALY CLOSED VALVE	AHU — AIR HANDLING UNIT
NORMALY OPENED VALVE	MOTORIZED WATER CIRCULATION PUMP
BUTTERFLY VALVE (HAND OPERATED)	SILT FLUSHING LINE
DIAPHRAM VALVE	STRAINER
NON - RETURN VALVE	
AUTOMATIC SELF CLEANING WEDGE WIRE CANDLE TYPE FILTER	

NOTE:-

1. AHU's SHOWN ARE INDICATIVE ONLY
1. INSTRUMENTATION CONFIGRATION SHALL BE FINALISED DURING ENGINEERING

TENDER DRAWING
NOT FOR CONSTRUCTION

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URI-I STAGE-II H E PROJECT

COOLING WATER DIAGRAM FOR VENTILATION SYSTEM

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH

DATE	DRG. NO.	
JAN-25		NH/DEM/URI-I STG-II /AC/02

FOR OFFICES / STORE AND
CABLE SPREADING ROOM / CABLE TRAYS

TAPPING FROM TRT
U#2
U#1

TO TRT/ DT

FIRE FIGHTING TANK
RADAR TYPE LEVEL SENSOR
RADAR TYPE LEVEL SENSOR
LI LS LT LT LS LI
HL HL
FIRE FIGHTING
STORAGE TANK
LL LL
VLL VLL
OVERFLOW
TO DRAIN
VISUAL
OVERFLOW
TO DRAIN
TO DRAIN TO DRAIN

MAKE WATER
TANK
BOREWELL

CABLE TUNNEL

BULK OIL
STORAGE TANK

GIS HALL

I/C CABLE GALLERY

TO MAKE WATER TANK
BUS REACTOR
TRANSFORMER CAVERN

GOVERNOR OPU
GOVERNOR OPU
UNIT-1
UNIT-2
Generator floor
Turbine floor
MIV OPU
TO SHAFT SEAL
MIV OPU

LEGEND:-

- NORMALLY OPEN VALVE
- NORMALLY CLOSED VALVE
- MOTORIZED VALVE WITH MANUAL OVER RIDE
- GATE VALVE
- HAND OPERATED BUTTERFLY VALVE
- CHECK VALVE
- LEVEL SWITCH
- MOTORISED WATER CIRCULATION PUMP
- AUTOMATIC SAELF FLUSHING WEDGEWIRE CANDLE TYPE FILTER
- WET SPRINKLER SYSTEM
- DELUGE SYSTEM
- VALVE WITH COUPLING (HYDRANT)
- PRESSURE SAFETY VALVE
- Y-STRAINER
- RADAR TYPE LEVEL SENSOR

TENDER DRAWING
NOT FOR CONSTRUCTION

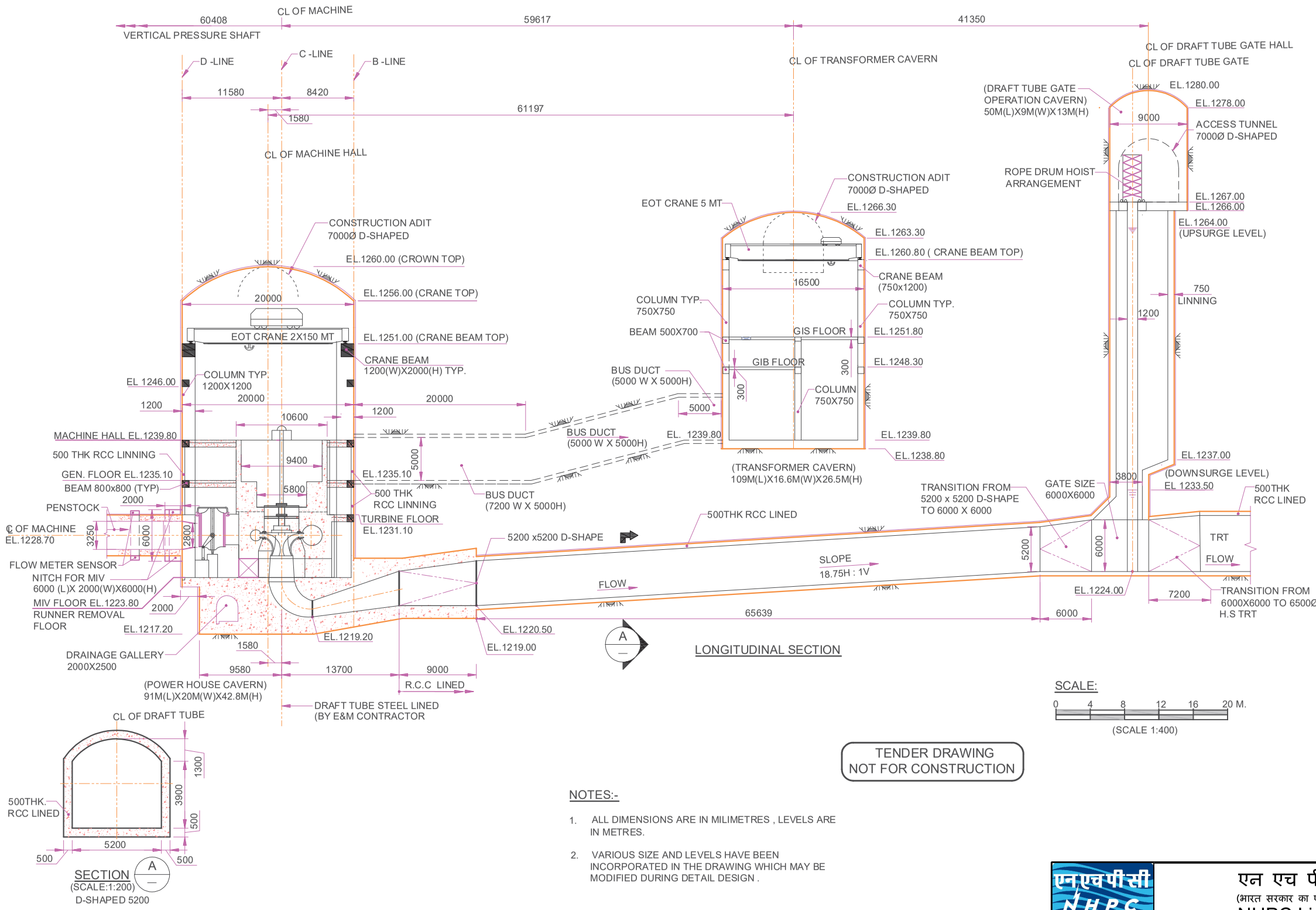
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URI-I STAGE-II H E PROJECT

FIRE FIGHTING SYSTEM

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH

DATE	DRG. NO.	NH/DEM/URI-STG-II/FF/01
JAN-25		



TENDER DRAWING
NOT FOR CONSTRUCTION

NOTES:-

1. ALL DIMENSIONS ARE IN MILIMETRES , LEVELS ARE IN METRES.
2. VARIOUS SIZE AND LEVELS HAVE BEEN INCORPORATED IN THE DRAWING WHICH MAY BE MODIFIED DURING DETAIL DESIGN .

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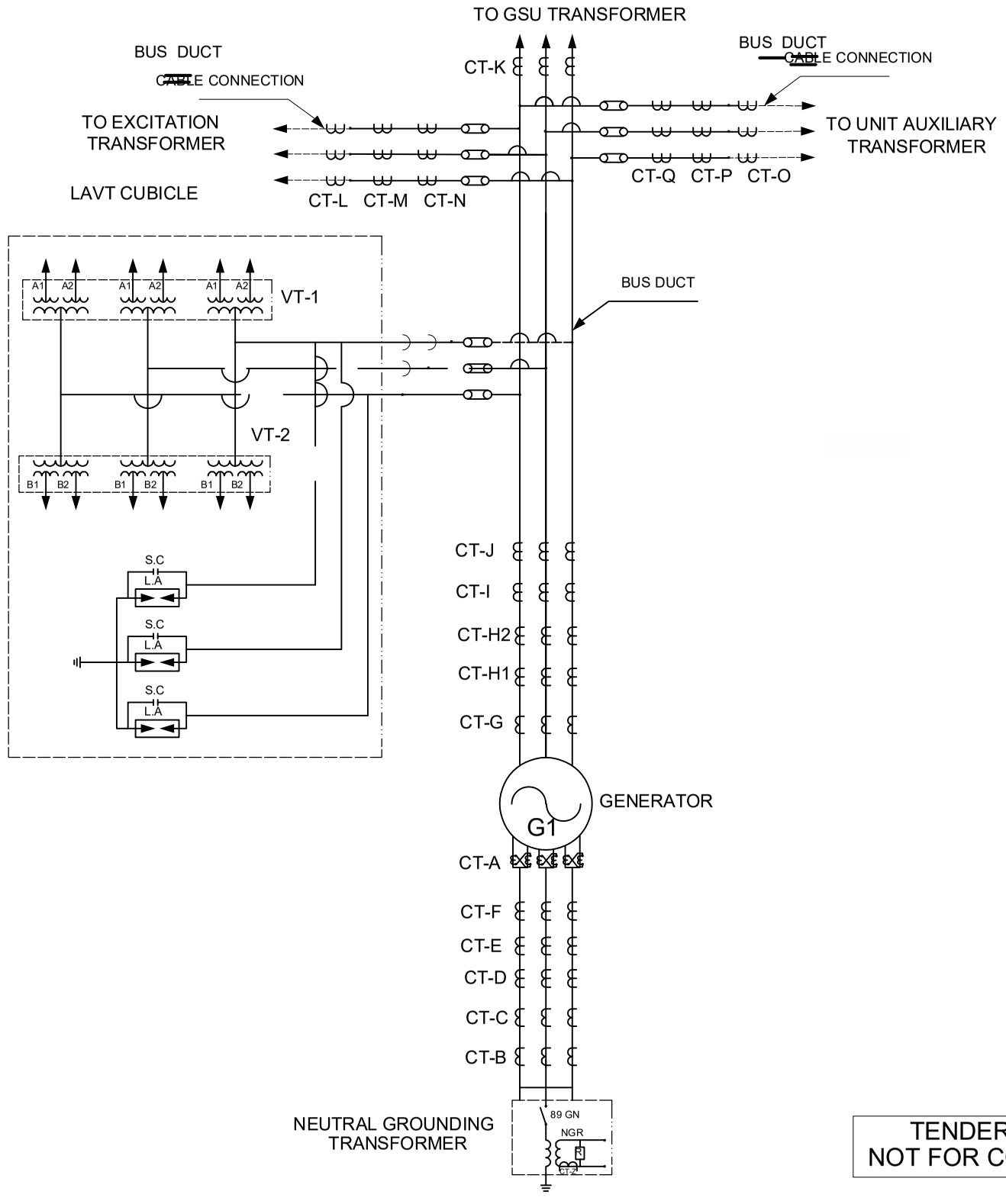
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URI-I STAGE-II H E PROJECT

POWER HOUSE LIMIT OF SUPPLY

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	REKHA KUMARI	P C SHARMA	N K SINGH
DATE	DRG. NO.	NH/DEM/URI-I STG-II /PH/01	
JAN-25			

Attachment 7_Technical_D_Amendment_01



SCHEDULE OF BUS DUCT (13.8 KV) CT

DESIGNATION	PURPOSE	ACCURACY	VA / VKp / Im	QTY.
CT-A	SPLIT PHASE PROTN.	P S	DURING DETAIL ENGINEERING	3SET*
CT-B	GT.OVER ALL DIFF.PROTN.	P S		3
CT-C	GEN. INTEG. PROTN.	P S		3
CT-D	GEN. INTEG. PROTN.(DUP.)	P S		3
CT-E	PMU	0.2S		3
CT-F	METERING	0.2S		3
CT-G	GOVERNOR	0.2S		3
CT-H1	DVR-1	0.2S		3
CT-H2	DVR-2	0.2S		3
CT-I	GEN. INTEG. PROTN.(DUP)	PS		3
CT-J	GEN. INTEG. PROTN.	PS		3
CT-K	GT. DIFF. PROTN.	PS		3
CT-L	ET O/C PROTECTION	5P20		3
CT-M	METERING	0.2S		3
CT-N	GT.OVERALL DIFF. PROTN.	PS		3
CT-O	METERING	0.2S		3
CT-P	UTT O/C PROTECTION	5P20		3
CT-Q	GT.OVERALL DIFF. PROTN.	PS		3
CT-Z	20HZ CT FOR 100% SEF			1

SCHEDULE OF BUS DUCT (13.8 KV) PT

DESIGNATION	RATIO	PURPOSE	ACCURACY	BURDEN VA	QTY.
VT-1	$\frac{13.8}{\sqrt{3}}$ KV / $\frac{110}{\sqrt{3}}$ V / $\frac{110}{\sqrt{3}}$ V	PROTECTION, METERING SEE & SYNCHRONIZATION	A1:- 3P A2:- 0.2	DURING DETAIL ENGINEERING	3
VT-2	$\frac{13.8}{\sqrt{3}}$ KV / $\frac{110}{\sqrt{3}}$ V / $\frac{110}{\sqrt{3}}$ V	PROTECTION, METERING SEE & GOVERNOR	B1:- 3P B2:- 0.2		3

NOTE:-

1. INDICATIVE SCHEME IS SHOWN FOR ONE GENERATING UNIT ONLY.
2. SCHEME FOR OTHER 2 GENERATING UNIT SHALL BE IDENTICAL
3. SCHEME SHOWN ARE INDICATIVE ONLY.
4. BURDEN ETC. OF CT / PT SHALL BE FINALISED DURING DETAILED ENGG.

* QTY. IN 1SET TO BE AS PER NO. OF PARALLEL PATH

TENDER DRAWING
NOT FOR CONSTRUCTION

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NHPC Limited
(A GOVT OF INDIA NAVRATNA ENTERPRISE)

URI-I STAGE-II HE PROJECT

CT / PT DETAILS OF BUS DUCT

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE	DRG. NO.	NH/DEM/URI-I STG-II/BD/01	
JAN-25			

GPS

02 nos. 162" Large Screen Display

REDUNDANT HOT STANDBY SERVER FOR
ADMINISTRATIVE CONTROL/ WEB/ MATERIAL MANAGEMENT & URI 1 PS CONTROL ROOM

6 NOS. PLANT COMPUTERS

2 NOS. LASER PRINTER

REDUNDANT POWER HOUSE ETHERNET LAN-MIS NETWORK (1GBPS)

TO LDC
(PLCC & OPGW PANEL)

HARDWARE
FIRE WALL

OPERATOR WORK STATIONS

DISPLAY
CONTROLLER

STATION -1

STATION -2

ENGG. STN.

ROUTER/GATEWAY WITH
NECESSARY PROTOCOL
CONVERTER/MODEM & FIREWALL

EVENT & DATA
LOGGING COLOUR
PRINTER

COLOUR LASER
PRINTER A3 SIZE

REDUNDANT ON LINE DATA STORAGE SYSTEM

NAS-1

NAS-2

ROUTER WITH
FIREWALL

WIRELESS
HOTSPOTS
CONNECTIONS

TO Remote Control Center
(Through P2P Network to Corporate center)

HARDWARE
FIRE WALL

GATEWAY/RTU INTERFACE WITH
NECESSARY PROTOCOL
CONVERTER/MODEM & FIREWALL

DMZ

POWER HOUSE LAN

TCP/IP ETHERNET LAN CONTROL ROOM NETWORK (1 GBPS)

PORTABLE ENGINEERING STN.
LAPTOP
PC

ETHERNET SWITCH

ETHERNET SWITCH

ETHERNET SWITCH

ETHERNET SWITCH

PORTABLE OPERATOR STN.
WITH PRINTER (1 NO.)
LAPTOP
PC
LASER
PRINTER

OPERATOR WORK STATION
TO BE INSTALLED AT URI-I PS

REDUNDANT FIBRE OPTIC PLANT CONTROL NETWORK

PROCESS CONTROL NETWORKS

URI-I STAGE-I POWER HOUSE
FOR DATA EXCHANGE e.g. RESEVOIR
DATA GENERATION DATA ETC.

HMI

UCB - 1

UNIT-1

REDUNDANT FIELD BUS

LCC

I/O

LOCAL NETWORK

EXCITATION SYSTEM

GOVERNING SYSTEM

PROTECTION SYSTEM

HMI

UCB - 2

UNIT-2

REDUNDANT FIELD BUS

LCC

I/O

LOCAL NETWORK

EXCITATION SYSTEM

GOVERNING SYSTEM

PROTECTION SYSTEM

HMI

420 KV GIS
& POTYARD
AREA

REDUNDANT FIELD BUS

LCC

I/O

LOCAL NETWORK

HMI

STATION, COMMON
SERVICES & DAM
MONITORING

LCB

REDUNDANT FIELD BUS

LCC

I/O

LOCAL NETWORK

HMI

ELECTRICAL
POWER SUPPLY

LCB

REDUNDANT FIELD BUS

LCC

I/O

LOCAL NETWORK

---------- HARDWIRED CONNECTION
——— SOFT CONNECTION

LEGEND:-

HMI – HUMAN MACHINE INTERFACE
LCB – LOCAL CONTROL BOARD
UCB – UNIT CONTROL BOARD
LCC – LOCAL CONTROL CUBICLE
I/O – INPUT AND OUTPUT
RTU – REMOTE TRANSMISSION UNIT
LDC – LOAD DISPATCH CENTRE
GPS – GLOBAL POSITIONING SYSTEM
TCP – TRANSMISSION CONTROL PROTOCOL
IP – INTERNET PROTOCOL
VSAT – VERY SMALL APERTURE TERMINAL
LAN – LOCAL AREA NETWORK
NAS – NETWORK ATTACHED STORAGE
OFC – OPTICAL FIBRE CABLE
MIS – MANAGEMENT & INFORMATION SYSTEM
RCC – REMOTE CONTROL CENTRE

TENDER DRAWING
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URI-I STAGE-II H E PROJECT

COMPUTERIZED CONTROL
AND MONITORING SYSTEM

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE	DRG. NO.	NH/DEM/URI-ISTG-II/CP/02	
JAN-25			

LP AIR COMPRESSOR SYSTEM

BLOWDOWN COMPRESSED AIR SYSTEM

U#1
DT DRAIN PURGING

PURGING COOLING
SUPPLY LINE

U#2
TO SHAFT SEAL

TO SHAFT SEAL

DT DRAIN

UNIT-2
BRAKE

FOR GENERATOR BRAKE SYSTEM

UNIT-1
BRAKE

SAFETY
VALVE

PRV

UNIT-1 SPIRAL /
DRAFT TUBE

UNIT-2 SPIRAL /
DRAFT TUBE

PURGING COOLING
SUPPLY LINE

DT DRAIN

DT DRAIN PURGING

TO SHAFT SEAL

TO SHAFT SEAL

GIS HALL

SERVICE BAY

TRANSFORMER CAVERN

BUS
DUCT

BUS
DUCT

(GENERATOR FLOOR)

UNIT-1

UNIT-2

CLOSED LOOP

(TURBINE FLOOR)

(MIV FLOOR)

LEGEND:-

1 — LP AIR RECIEVER

2 — MASTER GENERATOR BRAKE AIR RECIEVER

3 — AIR RECIEVER

4 — AIR DRYER

PRESSURE REDUCER

EQUIPMENT AIR SUPPLY

VALVE WITH COUPLING

VALVE

BLOW DOWN AIR COMPRESSOR

NRV

PRESSURE INDICATOR

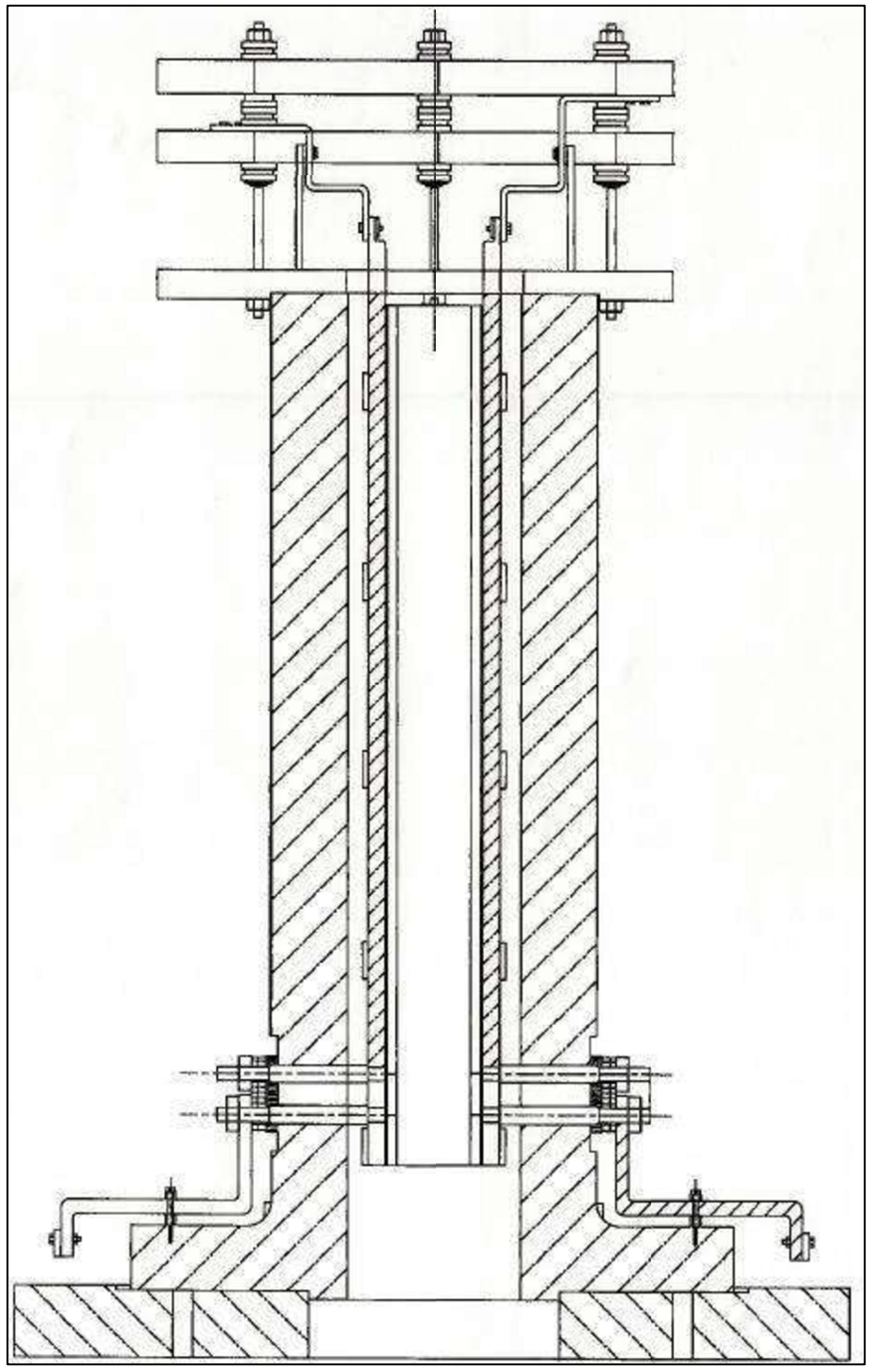
TENDER DRAWING
NOT FOR CONSTRUCTION

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(A GOVT OF INDIA NAVRATNA ENTERPRISE)

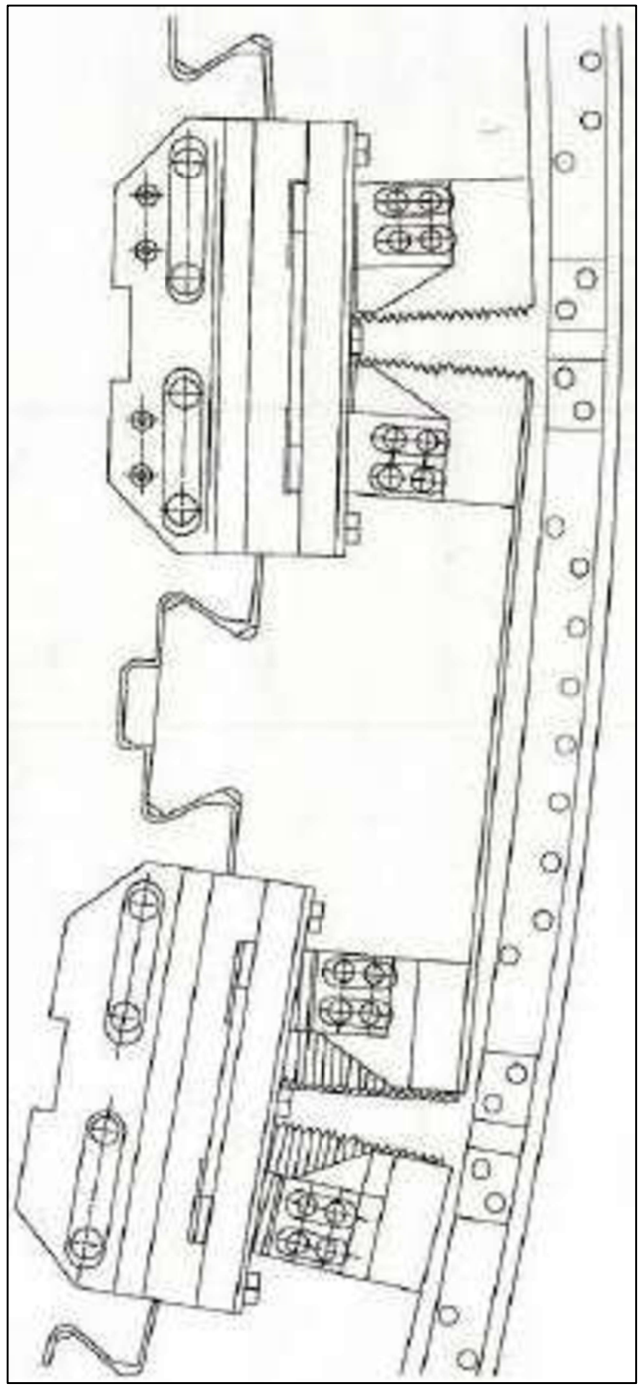
URI-I STAGE-II H E PROJECT

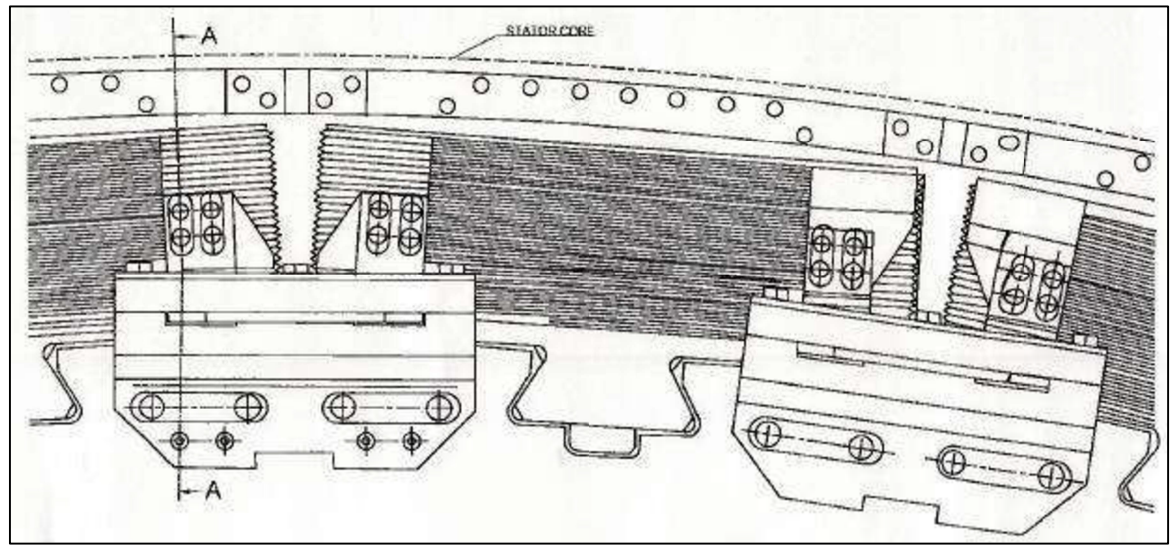
SCHEMATIC DIAGRAM
COMPRESSED AIR SYSTEM

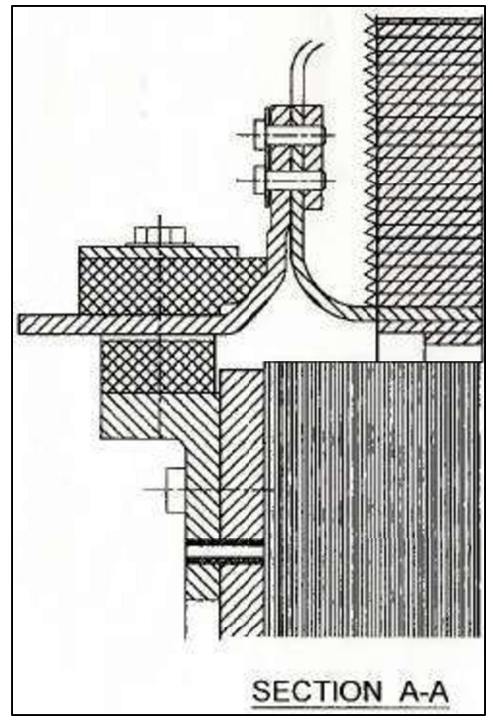
DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P.C. SHARMA	N.K. SINGH
DATE JAN-25	DRG. NO.	NH/DEM/URI-ISTG-II/CA/01	



ROTOR LEAD CONNETION THROUGH SHAFT (TYPICAL)







ROTOR POLE INTERCONNECTION (TYPICAL)

TENDER DRAWING
NOT FOR CONSTRUCTION

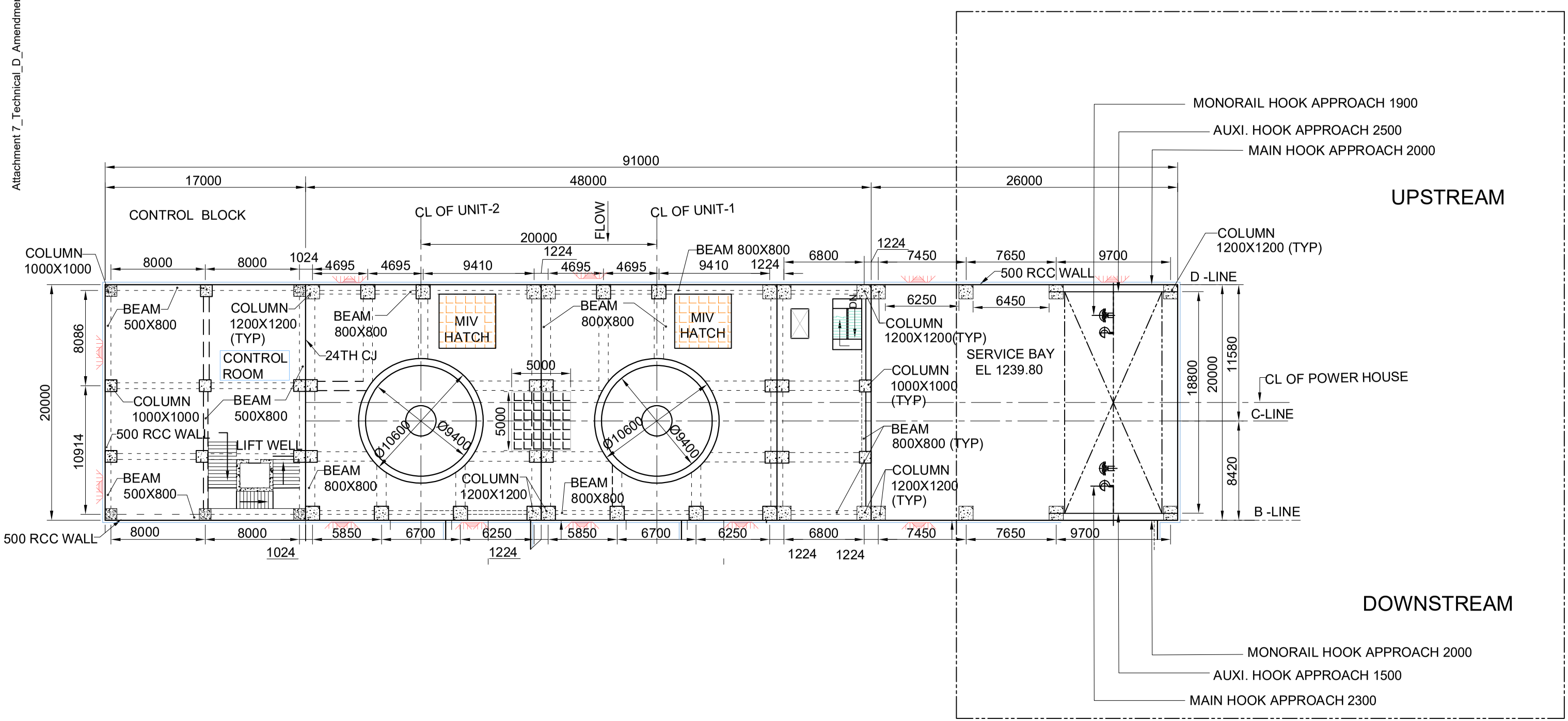
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(A GOVT. OF INDIA NAVRATNA ENTERPRISE)

URI-I STAGE-II H.E. PROJECT

ROTOR LEAD CONNECTION THROUGH SHAFT (TYPICAL)
&
ROTOR POLE INTERSECTION (TYPICAL)

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N.K. SINGH

DATE	DRG. NO.		REV. NO.
JAN-25		NH/DEM/URI-I STG-II/GEN/01	00



0 4 8 12 16 20 M.

(SCALE 1:400)

TENDER DRAWING
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(भारत सरकार का एक नवरत्न उपम)
NHPC Limited
(A GOVT OF INDIA NAVRATNA ENTERPRISE)
एक नवरत्न कंपनी

URI-I STAGE-II H E PROJECT

EOT CRANE

DRAWN	SUBMITTED	RECOMMENDED	APPROVED
AZAD	MITESH KUMAR	P C SHARMA	N K SINGH
DATE	DRG. NO.	NH/DEM/URI-ISTG-II/ET/01	
JAN-25			

Lot-III: Electro-Mechanical works of (2X120 MW) Uri-I Stage-II HE Project
Tender Reference No.: NH/Conts(EnM)-III/Uri-I Stage-II/ENM/2025/01 & ID No. 2025_NHPC_861342_1

AUTHORISED AMENDMENTS

Technical_Q_Amendment_01

Sr.No.	Volume / Clause No. & Name / Page No.	Existing Clause of MQAP/QTS	Modified Clause
1	Volume-III D / 1.2.5 Impact and Bend Tests / Page 7 of 306	Steel products for all principal turbine and shut-off valve parts shall be tested for impact resistance using the ISO V-notch specimen. Both longitudinal and transverse impact tests shall be performed on plate steel. Bend tests shall be performed on specimens of all major steel castings and forgings in accordance with the applicable DIN standards. The nil ductility transition temperature shall be the temperature at which the impact resistance is at the values specified above.	Steel products for all principal turbine and shut-off valve parts and all major steel castings & forgings shall be tested for chemical & mechanical analysis (Tensile, Hardness, Impact & Bend test etc.) as per applicable material standard.
2	Volume-III D / 24.3 Field Test / Page 61 of 306	Operational Test on Pump-Motor Assembly for measurement of Head, Rate of Flow, Speed, Power Input & Efficiency	Operational Test on Pump-Motor Assembly for measurement of Head, Rate of Flow, Speed & Power Input.
3	Volume-III D / 25.3 Field Test / Page 63 of 306	Operational Test on Pump-Motor Assembly for measurement of Head, Rate of Flow, Speed, Power Input & Efficiency.	Operational Test on Pump-Motor Assembly for measurement of Head, Rate of Flow, Speed & Power Input.
4	Volume-III D / B ii) Model QAP-Generator -Stator Punching / Page 113 of 306	A Raw Material (CRNGO) Material Properties Grade of Material, Nominal Thickness, Specific Loss, Magnetic Polarization, Anisotropy of loss, Stacking factor, Conventional Density Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	Generator-Stator Punching A Raw Material(CRNGO) i)Grade of Material, Nominal Thickness, Anisotropy of loss, Conventional Density-Quantum of Checks-Sample Plan,Record Format-TC,Remarks-TC ii)Stacking factor,Specific Total Loss,Magnetic Polarization, Quantum of Checks-Sample,Record Format-JIR,Remarks-CHP
5	Volume-III D / B ii) Model QAP-Generator -Stator Punching / Page 113 of 306	B- In Process i)Check of Burr Level in Punching ii) Stacking factor iii)Check for Quality of Lamination Varnishing, Thickness & IR value iv) Specific Total Loss v) Magnetic Polarization vi)Dimensional checking (Punching Thickness, Waviness, Packet size & Height) vii) Trail Assembly of Punching (Core dia , Core Height etc) Quantum of Checks-Sample Plan ,Record Format-JIR,Remarks-CHP	B In Process i) Check of Burr Level in Punching ii) Check for Quality of Lamination Varnishing,Thickness & IR value iii) Dimensional checking (Punching Thickness,Waviness, Packet size & Height) iv) Trail Assembly of Punching (Core dia ,Core Height etc) Quantum of Checks-Sample,Record Format-JIR,Remarks-CHP (This test shall be witnessed at manufacturer's works when stacking done at manufacturer Premises otherwise same shall be carried out at site during field test in the presence of authorized representative of Engineer-Incharge of NHPC Limited)
6	Volume-III D / A ii) Model QAP - Stator Winding Bar / Page 115 of 306	1 Raw Material B v) Resistivity Measurement	1 Raw Material B v) Resistivity Measurement-Deleted

Lot-III: Electro-Mechanical works of (2X120 MW) Uri-I Stage-II HE Project
Tender Reference No.: NH/Conts(EnM)-III/Uri-I Stage-II/ENM/2025/01 & ID No. 2025_NHPC_861342_1

AUTHORISED AMENDMENTS

Technical_Q_Amendment_01

Sr.No.	Volume / Clause No. & Name / Page No.	Existing Clause of MQAP/QTS	Modified Clause
7	Volume-III D / B iii) Model QAP-Generator- Guide Bearing (Upper & Lower) Pads / Page 126 of 306	Generator -Guide Bearing (Upper & Lower) B Final Inspection iv) Trial assembly of Complete Bearing Quantum of Checks-Sample Plan ,Record Format-JIR,Remarks-CHP	Generator -Guide Bearing (Upper & Lower) B Final Inspection iv) Trial assembly of Complete Bearing Quantum of Checks-Sample Plan ,Record Format-TC/COC,Remarks-TC/COC
8	Volume-III D / 2.5 i),ii) & iii) Model QAP-Service Elevator / Page 304 of 306	2.2 Satisfactory Operation of each controller, switch, contactor,starter, retiring cam,relay & other control devices and the correct operation of all limit switches under the most unfavourable conditions. 2.5 IR & HV Test for Control Panel i) Between the live parts & case or frame with all circuits completed. ii) Between main terminals or equivalent parts with all circuits open. Iii) Between any live parts of independent circiuts	2.2 Satisfactory Operation of each controller, switch, contactor,starter, retiring cam,relay & other control devices and the correct operation of all limit switches under the most unfavourable conditions shall be demonstrated through simulation process at shop floor. 2.5 IR & HV Test for individual Control Panel shall be done at shop. Clause 2.5 i), ii) & iii) shall be conducted at site, hence deleted.
9	VOLUME – III D: (QUALITY ASSURANCE PLAN) : MODEL-Static Excitation System / A.1 Bought Out items / Pdf Page 131 /306	A Bought Out items Thyristors, PCB, Diodes, Heat sink, Filters, Surge Suppression. Device etc. Quantum of Checks-100% ,Record Format-TC,Remarks-TC	A Bought Out items Thyristors, PCB, Diodes, Heat sink, Filters, Surge Suppression. Device etc. Quantum of Checks-100%,Record Format-TC /COC,Remarks-TC Shall be provided for Major Items and COC shall be provided for minor items.
10	VOLUME – III D / A.4 Raw Material / Pdf Page 136 /306	Excitation transformer (Dry Type) A 4 Fibre glas sheet / Insulation Barriers Quantum of Checks-Sample Plan,Record Format-TC ,Remarks-TC	Excitation transformer (Dry Type) A 4 Fibre glas sheet / Insulation Barriers Quantum of Checks-Sample Plan,Record Format-TC /COC,Remarks-TC/COC
11	VOLUME – III D / B.4 Raw Material / Pdf Page 137 /306	B Fittings & Accessories 4 PTC Thermistor with Alarm and Trip Device Quantum of Checks-100% ,Record Format-TC,Remarks-TC	B Fittings & Accessories 4 PTC Thermistor with Alarm and Trip Device(If applicable) Quantum of Checks-100% ,Record Format-TC,Remarks-TC
12	MODEL QUALITY ASSURANCE PLAN (QAP) FOR 400 kV XLPE cable / 2 (g)-ii Electrical Type Test on Cables/ Pdf Page 169 /306	2 Electrical Type test on cables g(ii) High Voltage Test in water Immersion Quantum of Checks-Sample,Record Format-TC,Remarks-TC	2 Electrical Type test on cables g(ii) High Voltage Test in water Immersion Quantum of Checks-Sample,Record Format-TC,Remarks-TC (Applicability of test shall be as per approved design/Tech Specification/IS /Relevant Standard)
13	MODEL QUALITY ASSURANCE PLAN (QAP) FOR 400 kV XLPE cable / 5(f) Acceptance Test/ Pdf Page 170 /306	5 Acceptance Test f) IR & HV Test Quantum of Checks-Sample,Record Format-JIR,Remarks-CHP	5 Acceptance Test f) HV Test Quantum of Checks-Sample,Record Format-JIR,Remarks-CHP
14	MODEL QUALITY ASSURANCE PLAN (QAP) FOR UPS / B-2 FINAL INSPECTION / Pdf Page 184/306	B Final Inspection 2 Functional Check including battery back-up test, alarm / indication test and protective functions Quantum of Checks-100% ,Record Format-JIR,Remarks-CHP	B Final Inspection 2 Functional Check including battery back-up test, alarm / indication test and protective functions Quantum of Checks-100% ,Record Format-TC/COC,Remarks-TC/COC

AUTHORISED AMENDMENTS

Technical_Q_Amendment_01

Sr.No.	Volume / Clause No. & Name / Page No.	Existing Clause of MQAP/QTS	Modified Clause
15	MODEL QUALITY ASSURANCE PLAN (QAP) FOR: DC System - AC & DC DISTRIBUTION BOARD / 3 Components / Pdf Page 185 /306	3 .Components - DC contactors, Indicating lamps ,MCB,MCCB, Fuse,Switch,Push Buttons, Meters, Lamps, Electronic card onvertor & Diode (applicable for 220/48V DC-DC convertor Quantum of Checks-100% ,Record Format-TC,Remarks-TC	3 .Components - DC contactors, Indicating lamps ,MCB,MCCB, Fuse,Switch,Push Buttons, Meters, Lamps, Electronic card onvertor & Diode (applicable for 220/48V DC-DC convertor Quantum of Checks-100% ,Record Format-TC/COC,Remarks-TC/COC
16	MODEL QUALITY ASSURANCE PLAN (QAP) FOR: 220V BATTERY CHARGER / 2 (a) Cables / Pdf Page 187 /306	2 Cables a) Surface defects Quantum of Checks-100% ,Record Format-TC,Remarks-TC	2 Cables a) Surface defects Quantum of Checks-100% ,Record Format-TC/COC,Remarks-TC/COC
17	11 kV XLPE cable / A.1(b) Copper Conductor/Rod / Pdf Page 202 /306	A Raw Material and Bought Out Items A1 Copper Conductor/Rod b) No. of Strands/ Lay Direction Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	C Routine Test Copper Conductor/Rod- No. of Strands/ Lay Direction Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC
18	11 kV XLPE cable / A.1(c) Copper Conductor/Rod / Pdf Page 202 /306	A Raw Material and Bought Out Items A1 Copper Conductor/Rod c) DC Resistance Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	C Routine Test Copper Conductor/Rod- DC Resistance Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC
19	11 kV XLPE cable / A.1(d) Copper Conductor/Rod / Pdf Page 202 /306	A Raw Material and Bought Out Items A1 Copper Conductor/Rod d) Resistivity Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	A Raw Material and Bought Out Items A1 Copper Conductor/Rod d) Conductivty Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC
20	11 kV XLPE cable / A.3(e) Copper Tap / Pdf Page 203 /306	A Raw Material and Bought Out Items 3 Copper Tape e) ID / OD of Coil Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	Deleted
21	1.1 kV XLPE Cable / A.2(b) Copper Conductor/Rod / Pdf Page 206 /306	A Raw Material and Bought Out Items A2 Copper Conductor/Rod b) No. of Strands & Lay Direction Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	C Routine Test Copper Conductor/Rod- No. of Strands/ Lay Direction Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC
22	1.1 kV XLPE Cable / A.2(c) Copper Conductor/Rod / Pdf Page 206 /306	A Raw Material and Bought Out Items A2 Copper Conductor/Rod c) DC Resistance Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	C Routine Test Copper Conductor/Rod- DC Resistance Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC
23	1.1 kV XLPE Cable / A.2(d) Copper Conductor/Rod / Pdf Page 206 /306	A Raw Material and Bought Out Items A2 Copper Conductor/Rod d) Resistivity Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	A Raw Material and Bought Out Items A2 Copper Conductor/Rod d) Conductivty Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC

Lot-III: Electro-Mechanical works of (2X120 MW) Uri-I Stage-II HE Project
Tender Reference No.: NH/Conts(EnM)-III/Uri-I Stage-II/ENM/2025/01 & ID No. 2025_NHPC_861342_1

AUTHORISED AMENDMENTS

Technical_Q_Amendment_01

Sr.No.	Volume / Clause No. & Name / Page No.	Existing Clause of MQAP/QTS	Modified Clause
24	Cabling System- Control and Instrumentation / A.1(b) Copper Conductor/Rod / Pdf Page 209 /306	A Raw Material and Bought Out Items A1 Copper Conductor/Rod b) No. of Strands/ Lay Direction Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	C Routine Test Copper Conductor/Rod- No. of Strands/ Lay Direction Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC
25	Cabling System- Control and Instrumentation / A.1(c) Copper Conductor/Rod / Pdf Page 209 /306	A Raw Material and Bought Out Items A1 Copper Conductor/Rod c) DC Resistance Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	C Routine Test Copper Conductor/Rod- DC Resistance Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC
26	Cabling System- Control and Instrumentation / A.1(d) Copper Conductor/Rod / Pdf Page 209 /306	A Raw Material and Bought Out Items A1 Copper Conductor/Rod d) Resistivity Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	A Raw Material and Bought Out Items A1 Copper Conductor/Rod d) Conductivty Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC
27	MODEL QUALITY ASSURANCE PLAN (QAP) FOR-Cable Tray and Cable Junction Box / A-1(c) (MS Sheet/Channel /Angle) / Pdf Page 211 /306	A Raw Material and Bought Out Items(MS Sheet/Channel/Angle) 1c) Surface Finish Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	A Raw Material and Bought Out Items(MS Sheet/Channel/Angle) 1c) Surface Finish Quantum of Checks-Sample Plan ,Record Format-TC/COC,Remarks-TC/COC
28	MODEL QUALITY ASSURANCE PLAN (QAP) FOR-MV SWITCHGEAR & AUXILIARY / A.3(a-d) FRP Sheets / Pdf Page 214 /306	A Raw Material and Bought Out Items 3) FRP Sheets a)Dimensional Check b) Dielectric Test c)Hygroscopic Test d)Fire Retardant Test Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	A Raw Material and Bought Out Items 3) FRP Sheets a)Dimensional Check b) Dielectric Test c)Hygroscopic Test d)Fire Retardant Test Quantum of Checks-Sample Plan ,Record Format-TC/COC,Remarks-TC/COC

Lot-III: Electro-Mechanical works of (2X120 MW) Uri-I Stage-II HE Project
Tender Reference No.: NH/Conts(EnM)-III/Uri-I Stage-II/ENM/2025/01 & ID No. 2025_NHPC_861342_1

AUTHORISED AMENDMENTS

Technical_Q_Amendment_01

Sr.No.	Volume / Clause No. & Name / Page No.	Existing Clause of MQAP/QTS	Modified Clause
29	MODEL QUALITY ASSURANCE PLAN (QAP) FOR-MV SWITCHGEAR & AUXILIARY / A. 5-7 / Pdf Page 214-216 /306	A Raw Material and Bought Out Items 5. Protective Relays (Over current & Earthault, Under voltage etc.) 6.KWH Meter 7. Indicating Instrument 10. HRC fuse 14. Switches/ Control Switches 16. Space Heater 18. Indicating Lamp, Push Button, Contact Block Quantum of Checks-100% ,Record Format-TC,Remarks-TC	A Raw Material and Bought Out Items 5. Protective Relays (Over current & Earthault, Under voltage etc.) 6.KWH Meter 7. Indicating Instrument 10. HRC fuse 14. Switches/ Control Switches 16. Space Heater 18. Indicating Lamp, Push Button, Contact Block Quantum of Checks-100%,Record Format-TC,Remarks-TC(The firm shall submit TC for major items and COC for minor items)
30	MODEL QUALITY ASSURANCE PLAN (QAP) FOR-MV SWITCHGEAR & AUXILIARY / A-8 MCCB, MCB & Contactor / Pdf Page 215 /306	A Raw Material and Bought Out Items 8 MCCB, MCB & Contactors Quantum of Checks-100% ,Record Format-TC,Remarks-TC	A Raw Material and Bought Out Items 8 MCCB, MCB & Contactors Quantum of Checks-100% ,Record Format-TC/COC,Remarks-TC/COC
31	MODEL QUALITY ASSURANCE PLAN (QAP) FOR-MV SWITCHGEAR & AUXILIARY / A-9, 12 & 13 / Pdf Page 215-216 /306	A Raw Material and Bought Out Items 9. Motor 12. Vacuum Interrupter 13. Spring Record Format-TC,Remarks-TC	A Raw Material and Bought Out Items 9. Motor 12. Vacuum Interrupter 13. Spring Record Format-TC/COC,Remarks-TC/COC
32	MODEL QUALITY ASSURANCE PLAN (QAP) FOR LV SWITCHGEAR SYSTEM AND AUXILIARY TRANSFORMERS / A(4-6,8,10-11) / Pdf Page 228-230 /306	A Raw Material and Bought Out Items 4. MCCB / MCB 5. Power & Auxiliary Contactor 6. Overload Relay 8.Timers 10.Space Heater 11.Switches/ Control Switches Quantum of Checks-100% ,Record Format-TC,Remarks-TC	A Raw Material and Bought Out Items 4. MCCB / MCB 5. Power & Auxiliary Contactor 6. Overload Relay 8.Timers 10.Space Heater 11.Switches/ Control Switches Quantum of Checks-100%,Record Format-TC,Remarks-TC(The firm shall submit TC for major items and COC for minor items)
33	MODEL QUALITY ASSURANCE PLAN (QAP) FOR ILLUMINATION SYSTEM / A.I. 1AI. 4 Raw Material / Pdf Page 240 /306	A Luminaries 1. Aluminium Casting 4. LED Driver Quantum of Checks-Sample Plan ,Record Format-TC,Remarks-TC	A Luminaries 1. Aluminium Casting 4. LED Driver Quantum of Checks-Sample Plan ,Record Format-TC/COC,Remarks-TC/COC

AUTHORISED AMENDMENTS

Technical_Q_Amendment_01

Sr.No.	Volume / Clause No. & Name / Page No.	Existing Clause of MQAP/QTS	Modified Clause
34	MODEL QUALITY ASSURANCE PLAN (QAP) FOR ILLUMINATION SYSTEM / A.I.3 Raw Material / Pdf Page 240 /306	A Luminaries 3 Paint Quantum of Checks-100% ,Record Format-TC,Remarks-TC	A Luminaries 3 Paint Quantum of Checks-Sample Plan ,Record Format-TC/COC,Remarks-TC/COC
35	MODEL QUALITY ASSURANCE PLAN (QAP) FOR ILLUMINATION SYSTEM / B.5 Raw Material & Bought Out Items / Pdf Page 243 /306	B1 Raw Materials & Bought Out Items MCCB, MCB, ELCB, Power & Auxiliary Contactors, Timer, Annunciater, Receptacle, Switches, Control Switches, Transducer, Current Transformer, Potential Transformer, Electrical Meters (Ammeter, Voltmeter, Energy meter), Indicator lamp, TB, Fuse, Space Heater,Thermostat etc. Quantum of Checks-100% ,Record Format-TC,Remarks-TC	B1 Raw Materials & Bought Out Items MCCB, MCB, ELCB, Power & Auxiliary Contactors, Timer, Annunciater, Receptacle, Switches, Control Switches, Transducer, Current Transformer, Potential Transformer, Electrical Meters (Ammeter, Voltmeter, Energy meter), Indicator lamp, TB, Fuse, Space Heater,Thermostat etc. Quantum of Checks-100%,Record Format-TC,Remarks-TC(The firm shall submit TC for major items and COC for minor items)
36	MODEL QUALITY ASSURANCE PLAN (QAP) FOR ILLUMINATION SYSTEM / C.2(a) Aluminium Ladder & Adjustable Platform / Pdf Page 244 /306	C2 Aluminium Ladder& Adjustable Plateform a) Raw Material Quantum of Checks-Sample Plan,Record Format-TC,Remarks-TC	C2 Aluminium Ladder& Adjustable Plateform a) Raw Material Quantum of Checks-Sample Plan ,Record Format-TC/COC,Remarks-TC/COC
37	MODEL QUALITY ASSURANCE PLAN (QAP) FOR ILLUMINATION SYSTEM / C.2(c) Aluminium Ladder & Adjustable Platform / Pdf Page 244 /306	C2 Aluminium Ladder& Adjustable Plateform c) Routine Test Quantum of Checks-Sample Plan,Record Format-TC,Remarks-TC	C2 Aluminium Ladder& Adjustable Plateform c) Routine Test(Make & Model) Quantum of Checks-100%,Record Format-TC,Remarks-TC
38	MODEL QUALITY ASSURANCE PLAN (QAP) FOR ILLUMINATION SYSTEM / C.3(a) Junction Box, Switchboard & Receptacle / Pdf Page 244 /306	C3 Junction Box, Switchboard & Receptacle a) Raw Material c) Routine Test Quantum of Checks-Sample Plan,Record Format-TC,Remarks-TC	C3 Junction Box, Switchboard & Receptacle a) Raw Material c) Routine Test Quantum of Checks-Sample Plan,Record Format-TC/COC,Remarks-TC/COC
39	MODEL QUALITY ASSURANCE PLAN (QAP) FOR ILLUMINATION SYSTEM / 6(a) Inverter, UPS & Battery / Pdf Page 244 /306	C6 Inverter, UPS & Battery a) Raw Material Quantum of Checks-Sample Plan,Record Format-TC,Remarks-TC	C6 Inverter, UPS & Battery a) Raw Material Quantum of Checks-Sample Plan,Record Format-TC/COC,Remarks-TC/COC
40	MODEL QUALITY ASSURANCE PLAN (QAP) FOR COMMUNICATION SYSTEM / A.6(i) Junction Box / Pdf Page 247 /306	A6 Junction Box i) Make, Model & Rating Quantum of Checks-Sample Plan,Record Format-TC,Remarks-TC	A6 Junction Box i) Make, Model & Rating Quantum of Checks-Sample Plan,Record Format-TC/COC,Remarks-TC/COC

Lot-III: Electro-Mechanical works of (2X120 MW) Uri-I Stage-II HE Project
Tender Reference No.: NH/Conts(EnM)-III/Uri-I Stage-II/ENM/2025/01 & ID No. 2025_NHPC_861342_1

AUTHORISED AMENDMENTS

Technical_Q_Amendment_01

Sr.No.	Volume / Clause No. & Name / Page No.	Existing Clause of MQAP/QTS	Modified Clause
41	MODEL QUALITY ASSURANCE PLAN (QAP) FOR COMMUNICATION SYSTEM / D.2 (i)-(ii) Routine Tests / Pdf Page 250 /306	D2 Routine Test i) Di-electric StrengthTest ii) Test on Protective Earthing Connections Quantum of Checks-100% ,Record Format-JIR,Remarks-CHP	D2 Routine Test i) Di-electric StrengthTest ii) Test on Protective Earthing Connections Quantum of Checks-100% ,Record Format-TC/COC,Remarks-TC/COC
42	IIID (MQAP & QTS) / 5.3,Pdf Page 28 /306	Determination of reactance's and time constants	Determination of reactance's and time constants shall be as per PTS clause no-5.3.3
43	IIID (MQAP & QTS) / 5.3 /.Pdf Page 28/306	Field Acceptance Test- Determination of values for Xd, X'd, X"d & Xq and time constants T'do, T'd, T"d & Ta.	Field Acceptance Test- Determination of values for Xd, X'd, X"d & Xq and time constants T'do, T'd, T"d & Ta shall be as per PTS clause no-5.3.3
44	IIID (QTS) / 1.4 /.Pdf Page 12/306	**1.4 Quality Control and Assurance** To ensure quality during each stage of work, the Contractor shall establish a system defining Quality Assurance Plan/Procedures during various stages of work.The Contractor shall maintain quality control during manufacturing of equipment as per the approved quality assurance plan. The Model Quality Assurance Plan for equipment / components for each section are given hereafter. Final Quality Assurance Plan (QAP) for manufacturing shall be approved during detailed engineering. The Bidder shall submit the detailed Quality Assurance Plan for the complete equipment/materials along with the bid for approval and acceptance by the Employer. This shall form integral part of the contract. The QAP shall include inspection and tests proposed to be conducted on raw material/bought out items at the time of induction in the process of manufacturing and at final stage of assembly. Based on the test certificate, inspection report dispatch clearance shall be issued by the employer. The materials/equipment/items shall only be dispatched after issue of material dispatch clearance certificate (MDCC). Detail Model Quality Assurance Plan is attached here with of each and every equipment/ auxiliaries. These are to be strictly observed /followed by the Manufacturer/ Contractor/ Vendor/Sub – Vendor/Supplier/Sub-Supplier. Inspections and tests shall be carried out by the Contractor in accordance with the Employer-approved Quality Assurance Plan (QAP), adhering to the Technical Specifications at various stages of manufacturing. Tests falling under the Customer Hold Point (CHP) category may be witnessed either physically or through video conferencing. The Employer reserves the right to witness these tests through either mode at the premises of the manufacturer or sub-vendor. CHP tests shall be conducted exclusively at Employer-approved vendor/sub-vendor/supplier premises, as specified in the Employer-approved documents (Contract, Technical Specifications, Guaranteed Technical Particulars [GTP], and Drawings.The Contractor shall follow approved Site Quality Assurance Plan/Field Quality Assurance Plan and installation procedures during installation and commissioning. The Contractor shall maintain the quality records during site installation and commissioning which shall be produced to Engineer-in-charge for approval at defined stages. Inspection and tests shall be carried out at site by contractor during installation and commissioning as described in relevant clauses.	**1.4 Quality Control and Assurance** To ensure quality during each stage of work, the Contractor shall establish a system defining Quality Assurance Plan/Procedures during various stages of work.The Contractor shall maintain quality control during manufacturing of equipment as per the approved quality assurance plan. The Model Quality Assurance Plan for equipment / components for each section are given hereafter. Final quality Assurance plan (QAP) for manufacturing shall be approved during detailed engineering. The Bidder shall submit the detailed Quality Assurance Plan for the complete equipment/materials along with the bid for approval and acceptance by the Employer. This shall form an integral part of the contract. The QAP shall include inspection and tests proposed to be conducted on raw material/bought out items at the time of induction in the process of manufacturing and at final stage of assembly. Based on the test certificate, inspection report dispatch clearance shall be issued by the employer. The materials/equipment/items shall only be dispatched after issue of material dispatch clearance certificate (MDCC).Detail Model Quality Assurance Plan is attached herewith of each and every equipment/auxiliaries. These are to be strictly observed/followed by the manufacturer/contractor/sub vender.Inspections and tests shall be carried out by the Contractor as per approved QAP with due regard to stipulations in inspection and Test of "General Technical Specification" at Various stages of manufacturing for assuring the full compliance of supply with the requirement of specification. Tests falling under the Customer Hold Point (CHP) category may be witnessed either physically or through video conferencing. The Employer reserves the right to witness these tests through either mode at the premises of the manufacturer or sub-vendor. CHP tests shall be conducted at Employer-approved vendor/sub-vendor/supplier premises, as specified in the Employer-approved documents.The Contractor shall follow the approved Site Quality Assurance Plan/Field Quality Assurance Plan and installation procedures . The Contractor shall maintain the quality records during site installation and commissioning which shall be produced to Engineer-in-charge for approval at defined stages.Inspection and tests shall be carried out at site by contractor during installation and commissioning as described in relevant clauses.

NHPC LIMITED
(A Govt. of India Navratna Enterprise)
NHPC Office Complex, Sector-33, Faridabad-121003, Haryana (India)
CIN: L40101HR1975GOI032564

Dated: 23.07.2025

Informative Replies

Name of Work: Lot-III: Electro-mechanical works package of 240 MW (2X120MW) Uri-I Stage-II H.E Project, Baramulla District of UT of J&K, India.

Ref: Tender Specification No. NH/ Conts(E&M)-III/ Uri-I Stage-II/ ENM/ 2025/ 01

[E-Tender ID: 2025_NHPC_861342_1]

The replies/clarifications against pre-bid & post pre-bid queries for the subject tender not affecting the terms and conditions of tender document is hereby attached as **"Informative Replies"** and annexed as Informative Replies (Part A, Part B, Part-C, Part-D & Part-E) for information please.

Sd/-

General Manager,
Contracts (E&M)-III,
2nd Floor, Jyoti Sadan, NHPC Office Complex,
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INFORMATIVE REPLIES

PART-A

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
1	Volume-0 NIT	---	NIT, Clause No. 1.1 (v), Estimated Cost	INR 485.40 Crore	Please clarify the Estimated Cost is with or without GST.	Inclusive of GST
2	Volume-0 NIT		NIT, Clause No. 1.2 (v), Critical Dates of Tender	Last Date of Receipt of queries/clarification on Bid : 13/06/2025 17:00 Hrs	Please appreciate NIT published on 07/06/2025 17:00 Hrs (Saturday Evening) that means only five working days are allotted for pre bid queries. We request you to kindly consider the same in progressive way by 20.06.2025 13.00 Hrs please.	NA
3	Volume-0 NIT		NIT, Clause No. 1.2 (vi), Critical Dates of Tender	Date & Venue of Pre bid Conference (Or e-meeting) (if required) : 20/06/2025 15: 00 Hrs (IST)	Please forward the e-Meeting link so that our company officials & experts from Turbine & Generator from distant places may also join.	NA
4	Volume-0 NIT		NIT, Clause No. 1.2 (vi), Critical Dates of Tender	On line Bid Submission End Date & Time : 25/07/2025 18:00 Hrs	Please consider On Line Bid Submission End Date & Time: 25/09/2025 18:00 Hrs	Please adhere to bid specifications
5	Vol0, ITB	Page No 93/306	Appendix V-B, No.A-1/2021-FSC-Part(5), Ministry of Power Order dated 16/11/2021, Vide Annexure-I (E.)	Minimum Local Content (MLC) percentages in EPC/Turnkey Project. In case the contract is awarded through EPC route, the contractor should comply with the requirement of MLC for individual items as listed in Annexure-I and should purchase these items only from Class-I Local Supplier. In addition, MLC for Complete EPC Project may also be prescribed as below: Annexure-I(1) Package Based Works (12) Hydro Power Projects (Electro-Mechanical Works): 60% Minimum Local Content.	(1) We propose the following: Minimum Local Content (MLC) percentages in EPC/Turnkey Project. In case the contract is awarded through EPC route, the contractor should comply with the requirement of MLC for individual items as listed in Annexure-I and should purchase these items only from Class-I Local Supplier or manufacture in their own Contractor works (2) In addition MLC for Complete EPC Project may also be prescribed as below: Annexure -I (1) Package Based Works (12) Hydro Power Projects (Electro-Mechanical Works): 60% Minimum Local Content. Please clarify the MLC should be 60% of the EPC contract price without GST, if our understanding is correct.	Bid conditions are quite clear. Please adhere to bid specifications
6	Vol II B SCC	Page 282-283/306		12. Financing Arrangement 12.1 In the event that the Employer make financing arrangement for the work package by means of Buyers Credit from International Banks through the Export Credit Agencies of the Country concerned to the extent the goods and services covered in the package are imported from OECD countries, the Contractor shall, in case of award of Contract, facilitate completion of any such formalities as may be required by the respective export credit agency to enable NHPC to avail Buyers Credit for funding eligible goods and services covered in the package. The Contractor shall make similar compliance in respect of its sub- vendors/sub- contractors to the extent the goods are imported from concerned OECD country, if applicable.	Please explain, Vide Vol. II A GCC, Clause No. 21.4, Page 194-195/306, Customs Clearance (Not applicable), Also Vide Vol.II B SCC, Clause No. 5.1, Page 274/306, Construction of the Contract: For Foreign Bidder (Not Applicable), then how it is possible to comply to Clause No. 12.1 (Financing Arrangement).	Please refer Corrigendum No.2
7	Vol-V (Forms & Procedures)	Page 99/315,	Attachment-5B: Specification Qualification Criteria for Subcontractors/ Vendors	Vide Clause 3.1, MIV (Fabrication & Manufacturing of MIV), It is mentioned as per qualification criteria. If the qualification criteria of bidder is vide Clause No. 2.2.7, Bids by merged/Acquired/ Subsidiary Companies of NIT, 'If the Bidder Company is a Subsidiary Company and applies for qualification on the unconditional technical and financial strength of the Parent Company/Holding Company, the same shall be considered.	If the Technology Provider is Foreign Company, then in order to manufacture MIV in India, can bidder consider the local vendors for the manufacturing of MIV.	Bid specifications are quite clear. Please adhere to bid specifications.
8	Vol-5 (Forms & Procedures)	Page 252-253/315,	Appendix-3: Insurance Requirements	Vide Clause No. (b) Erection All Risk Insurance: Contract Price of First & Second Contract plus 25% of sum (to cover price variation & taxes & duties etc) of First & Second Contract Price: From Commencement of work on site to end of defect liability period.	Kindly recommend the name of the insurance companies & contact details ready to provide insurance coverage to NHPC projects.	Please adhere to bid specifications. In respect of EAR, please refer Corrigendum No.2

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
9	NIT, Clause 2.2.1, General Experience		Clause 2.2.1, General Experience	Experience as a principal contractor or as partner in a Joint Venture or Sub-Contractor approved by the Employer of executing substantially completed large Electromechanical works in Last 20 years of following value of completed work done: 1. One Electro Mechanical work costing not less than INR 388.32 Crore , Or 2. Two Electro Mechanical works each costing not less than INR 242.70 Crore, Or 3. Three Electro Mechanical works each costing not less than INR 194.16 Crore. For such works with paadopting the Exchange rate between that Currency and INR as prevailing on the completion date mentioned in the completion certificate and if month of completion is mentioned in the Completion Certificate, then the exchange rate of last working day of the Month shall be taken. The value of work in INR or converted into INR as above from the currency other than INR shall be enhanced by 7% simple rate per annum up to the date of Bid Opening. In support of above, bidder should provide copy of work orders along with completion/ substantial completion certificate. Payment received in other than INR shall be converted in INR by.....	For clarity, we request to define Unit Capacity & Overall Capacity of Project in MW in this clause please	Bid specifications are quite clear. Please adhere to bid specifications.

INFORMATIVE REPLIES

PART-B

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarifications
1	ITB Cl. No. 2.2.1			**2.2.1 GENERAL EXPERIENCE:** Experience as a principal contractor or as partner in a Joint Venture or Sub-Contractor approved by the Employer of executing substantially completed large Electromechanical works in Last 20 years of following value of completed work done: 1. One Electro Mechanical work costing not less than INR 388.32 Crore, Or 2. Two Electro Mechanical works each costing not less than INR 242.70 Crore, Or 3. Three Electro Mechanical works each costing not less than INR 194.16 Crore.	We recommend that, Lift Irrigation Projects having Pump Motors are also having similar nature and complexity of work in comparison with Turbine and generator of Hydro Electric Projects. Hence, the value of Electro Mechanical components in a pump house may also be considered for General Experience Criteria. Please Confirm.	Please adhere to bid specifications.
2	ITB Cl. No. 2.2.2		SPECIFIC EXPERIENCE:	**2.2.2** SPECIFIC EXPERIENCE: Successful experience of completed works, either by the bidder Company itself or by the proposed manufacturer(s) (only in case of Main Inlet Valve) who have given authorization to the bidder in required format in Design, manufacturing, erection, testing and commissioning of the following electromechanical items and /or works in preceding twenty (20) years: **(i)** Turbine • Vertical shaft Francis Turbine having unit rated output of 60 MW or higher. (ii) Generator • Vertical shaft Synchronous generator having unit rated output of 71 MVA or higher. **(iii)** Main Inlet Valve • Main Inlet Valve-Spherical type of diameter 1.4 m or more, and rated for Head 113.5 m or higher In support of above, bidder should provide copy of Performance/ Successful operation certificate for at least 2 years from the date of commissioning issued by Purchaser/ Owner of the equipment. Note: **(i)** The start and completion date for General Experience & Specific Technical Experience should fall within the preceding twenty (20) years reckoned from the last day of the month previous to the one in which Bids are invited. **(ii)** Experience of Supervision of erection testing and commission of bidder shall also be considered at par with own erection, testing & commissioning of E&M equipment.	It is to submit that except principle, the methodology of Pumping Scheme (Pump and Motor) and Hydro Power Schemes are similar. In which the Pump & Motor are supplied by the almost same reputed manufacturers and erected the same by the EPC bidders under the Supervision of manufacturer expert. The qualification allows Supervision of erection, testing and commissioning of bidder shall also be considered at par with own erection, testing & commissioning of E&M equipment. In this regard we request to allow EPC bidders having Experience of erection, testing & commissioning of Pumps Motors of 71MW or higher as at par with experience of E&M equipment in HE Project. Please Confirm.	Please adhere to bid specifications.

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarifications
3	ITB Cl. No. 2.2.5		JOINT VENTURE / CONSORTIUM BIDDERS:	**2.2.5 JOINT VENTURE / CONSORTIUM BIDDERS:** Joint Venture bids shall comply with the following minimum qualifying requirements: (i) The number of partners in the joint ventures not to exceed two (02) with one of the partners designated as Lead Partner. (ii) The lead partner to fully meet the following: • General experience criteria as specified in Para 2.2.1, • Average annual turnover not less than 50% of the criteria specified in Para 2.2.3 (i), • Working capital criteria as specified in Para 2.2.3 (iii), • Specific Experience Criteria for the Critical Component works as specified in Para 2.2.2 (i) & (ii). (iii) The other partner to individually meet the following requirements: • Average annual turnover not less than 20% of the criteria specified in Para 2.2.3 (i), • Specific experience Criteria for the Component as specified in Para 2.2.2 (iii).	It is to submit that the bid document encourages to participate the bidders in the Joint Venture, but both partners should have either design & manufacturing experience of turbine or generator to form the Joint Venture. Further, we submit that the firm having experience of turbine will have generator experience and vice versa. When the firm having both the specific experience, there is no more requirement of Joint Venture partner. In this connection, we request to delete specific experience requirement for the lead partner of the joint venture. Such that the EPC bidder who is having general experience and financially sound can join hands with the manufactures of turbine generator for qualified competitive bid. Please Confirm.	Please adhere to bid specifications.
4	Volume-0 ITB		Cl. No.37-e-RA	**Conditions of Conducting e-RA after e-tendering** [...] e-Reverse auction is to be conducted if number of eligible bidders at price bid stage are at least 2 (two). As such, following procedure of e-RA is to be adopted: (a) If the discovered price is up to and including 105 % of the estimated price, no e-RA will be conducted. (b) If the discovered price is above the price mentioned in (a) above, then following procedure of e-RA is proposed: • In case the number of eligible Bidders is 3 or less than 3, then e-RA shall be conducted among all the bidders. • In case the number of eligible Bidders is 4, then e-RA shall be conducted among the bidders except HI. **In case the number of eligible Bidders is more than 4, then the bidders quoting higher rates shall be eliminated as per below formula, and e-RA shall be conducted among the remaining bidders:**	It is to submit that the Reverse auction is a failure model, which we seen earlier in the Wind Power Plants Projects. Sometimes in the process of reverse auction the bidders get excited and keen to take work but later the stage it is hard to execute and owner also faces difficulties in the completion of the project in time. In this regard, we request to add following condition for Reverse Auction Process, (a) (ii) if the difference between discovered prices of the L1 and L2 bidder are less than 3%, no e-RA will be conducted. Please Confirm.	Please adhere to bid specifications.

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarifications
5	Volume-IIA-GCC		General Conditions of Contract:13.2 Advance Payment Security 13.2.1	(i) An advance payment maximum of 10% of Contract Price (for supply portion only) may be released to the Contractor. Such advance payment shall be interest bearing which shall be at Long Term (3 years) MCLR of SBI plus margin of 150 basis points above MCLR as on 28 days prior to the last date of Bid Submission calculated on daily basis.	We submit that, the Electro Mechanical Package requires huge capital investment in the beginning of the project to place work orders to the different vendors for supply of goods, such that the project may be completed in time. **In this connection, we request to provide interest free advance payment of 10% of the entire contract value to the successful bidder on** submission of Bank Guarantee equivalent to 100% of the advance value. Please Confirm.	Please adhere to bid specifications..

INFORMATIVE REPLIES

PART-C

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/Clarifications
1	Volume-III B (PTS)	2-4	2.2.2 Hydraulic conditions	ix Operating range of net heads a Rated net Head b Maximum net head c Minimum net head	All the heads has been specified same values of 227 m. Kindly provide Maximum and Minimum net head.	This is ROR plant so MDDL and FRL are same. kindly adhere to tender specifications.
2	Volume-0 ITB	52 of 306	25.3 (d)	Turbine: During evaluation, loading on account of efficiency of Turbine shall be made in case weighted average efficiency is below 94.5%.	The requirement of weighted average efficiency seems to be on higher side, Kindly review.	Kindly adhere to tender specifications.
3	Volume-III C (TDS)	206 of 284	1.1 GTP 1.3 (a), (b)	Turbine weighted average efficiency with uncoated runner…. Minimum 94.0 % with coated runner…. Minimum 93.5 %	There is discrepancy in weighted average efficiency values from tender documents, Kindly review.	Please refer Corrigendum No. 2
4	Volume-III B (PTS)	4-12	4.1.1 Spherical valve & associated components	1) Two (2) sets of 2.8 m diameter turbine main inlet valves…	Employer is requested to allow bidder to decide main inlet valve diameter as per design and in line with spiral inlet diameter. Kindly confirm.	Kindly adhere to tender specifications.
5	Volume-III B (PTS)	2-7	2.4.3	Cavitation pitting guarantees: "------ subsequent to repair----guarantees for another period of 8000 ----"	Measure of extent of damage due to Cavitation and minor / major repairs should be governed by IEC 60609 . This is a regular International practice & followed in almost all the hydro tenders and accepted universally. Kindly accept & confirm.	Kindly adhere to tender specifications.
6	Electro-Mechanical Works, Volume-3B (PTS), Chapter-2,Turbines and Auxiliaries	2-9	2.4.6 (Model Acceptance tests), Sub Clause 2.4.6.2-Place of model test"	The Clauses states "Employer reserves the right to get the model tested in any of the renowned approved test laboratory or Contractor's facilities/ recommended agencies by the Contractor..... Nevertheless the Employer reserves the right to get the model test repeated in presence of both the parties in an internationally recognised independent laboratory at his own cost. The Contractor shall supply his model test data, method of testing from previous tests and turbine model, for each component of turbine, to the laboratory selected for conducting the tests, if it is different than the Contractor's facilities."	Employer's right for using third party's laboratory for model testing or for a repetition of model testing is not feasible considering protection of intellectual property since sharing of the turbine model leads to exposure of intellectual property i.e. the hydraulic design of the model. Turbine hydraulic design is itself proprietary in nature and can not be shared with third party. Its confidentiality is utmost important for our EM equipment. Accordingly, Employer is requested for conductance of model test only at our laboratory which is NABL accrediated. Please confirm	Kindly adhere to tender specifications.
7	Electro-Mechanical Works, Volume-3B (PTS), Chapter-2,Turbines and Auxiliaries	2-11	2.4.7 (Field Acceptance tests)	The Clauses states "The power output and efficiency tests on the turbine shall be made at net effective head as near as practicable to the rated net head. The efficiency test shall be made by the thermodynamic method"	As per IEC 60041; Thermodynamic method is used for high head (more than 100m head) turbines and as per the international practices this method is generally used for more than 300 m net head turbines for good results. Net head of around 227m for URI-I STG-II HEP, is at the lower limit of the head reccommded by IEC for this method and temperature measurement inaccuracies in thermodynamic method testing would be very high. Therefore the clause may be modified as "The efficiency test shall be made by the thermodynamic method or any other suitable method as per IEC 60041" Employer is requested to modify the clause accordingly.	Kindly adhere to tender specifications.
8	IIIB (PTS)	Page 5-1 & page 5-7	5.1.1 (vii) & 5.5.4	Radial jack	In this clause, it is specified that radial jacks shall be installed on each arm of upper bracket. Kindly note that Generator bearing arrangement shall be of semi-umbrella type, hence radial jack is not required on top bracket. However provision for mounting radial jack shall be provided. Kindly review & confirm.	Kindly adhere to tender specifications.
9	IIIB (PTS)	Page 5-2	CLAUSE xix & xxi	Partial discharge couplers/ sensors	Clause xix: 2 sets of couplers for online measurement of partial discharge. Clause xxi: PD sensors for each unit shall be provided as per clause no. 5.5.12.4 We understand that one set of coupler per unit shall be provided. Separately mentioned clause may be merged for avoiding confusion. Kindly review and confirm.	Kindly adhere to tender specifications.
10	IIIB (PTS)	Page 5-16	5.3.1, clause A & B	Maximum permissible temperature of Stator and rotor winding temperature	Maximum permissible temperature under overload condition for Stator winding temperature 105°C and roto winding temperature 105°C is mentioned . Which is on lower side. Temperature rise for stator and rotor winding should be as per IEC 60034-1. Please review and confirm.	Please refer Corrigendum No. 2
11	IIIB (PTS)	Page 5-9	CLAUSE 5.5.5.3	Stator bars shall be VPI insulated.	In this clause, insulation system for stator bars are mentioned VPI type. For 13.8KV system resin rich resiflex insulation system is proven technology with easy maintenance and replacement of individual bars. Employer is requested to give choice of insulation system VPI/ resin rich resiflex type to bidders.	Kindly adhere to tender specifications.

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/Clarifications
12	IIIB (PTS)	Page 5-16	5.5.12.4	Partial Discharge measurement and analysis system.	In the tender specification, it is specified that The PD Monitor must contain digital noise separation according to IEC/equivalent standard. PD monitor should have digital circuitry for clock speed (range of 800-1000 MHz) for separating noise (interference) pulses from PD pulses by directly recording the number and magnitude of the pulses. These technical requirements are vendor specific. PD monitor shall be supplied as per designed system of vendor approved by Employer during vendor approval stage of contract. Kindly confirm.	Please refer Corrigendum No. 2
13	IIIB (PTS)	Page 5-9	5.5.5.3	Split-phase protection	In this clause, Split-phase protection is specified. kindly note that Split-phase protection is used for detection of inter-turn short of the multi-turn coils & since bar type winding has only single turn, this protection is not applicable. Hence, may please be deleted. Please review and confirm.	Kindly adhere to tender specifications.
14	IIIB (PTS)	Page 5-11	5.5.9	Bearing : Bearing pad area	In this clause it is specified that Bearing pad area shall preferably be 55- 60% of journal area. In our opinion bearing pad area should be left to bidder. We confirm that pad temperatures will be as per tender specifications. Also limiting bearing pad area will affect the bearing losses and may result in lower efficiency of generator. Kindly review and confirm.	Kindly adhere to tender specifications.
15	IIIB (PTS)	Page 5-11/12	5.5.9	Bearing : piping of oil mist extractors system	In this clause, it is specified that The piping of oil mist extractors system shall comprise of PVC pipes and flexible hoses. If metal pipes are used, they shall be coupled with straub coupling in order to facilitate quick dismantling and erection. Our regular practice is to use metal pipes with rigid couplings and same has been used in all Hydro projects (Including Mangdechhu, Kishanganga, Parbati).. Please review and confirm	Kindly adhere to tender specifications.
16	IIIB (PTS)	Page 5-16	5.5.12.13	carbon dust collection system	In this clause, it is specified that the piping of carbon dust system shall comprise of PVC pipes and flexible hoses. Please note that The carbon dust will be collected in the tray mounted under slipring assembly on the brushgear casing to prevent mixing of carbon dust with the closed air ventilation system of generator. Additionally fan and filter assembly will be provided for sucking carbon dust and no pipes are required. Please review and confirm	Kindly adhere to tender specifications.
17	IIID (MQAP & QTS)		5.3	Determination of reactance's and time constants	Determination of reactance's and time constants is specified. For determination of above parameters we need to conduct Sudden short-circuit test on generator terminal. These are invasive tests and we do not recommend this test. However, we will furnish the calculated values of transient and sub transient reactance's and time constants during detail design. Hence these tests may be deleted. Please confirm the acceptance.	Kindly adhere to tender specifications.
18	IIID (MQAP & QTS)	Page 31 of 100	5.3	Field Acceptance Test - Determination of values for Xd, X'd, X"d & Xq and time constants T'do, T'd, T"d & Ta.	Determination of values for Xd, X'd, X"d & Xq and time constants T'do, T'd, T"d & Ta are specified. For determination of above parameters we need to conduct Sudden short-circuit test. In our opinion this test is an invasive test; hence we do not recommend this test. However, we will furnish the calculated values of transient and sub transient reactance's and time constants during detail design. Hence these tests may be deleted. Please confirm the acceptance.	Kindly adhere to tender specifications.
19	Vol-3D (MQAP)	Page 3 of 19	QAP	QAP (Generator Package – Stator Punchings In process: B(i), B(ii), B(iii)	In this Clause CHP is specified for (B) (i) Check of Burr Level in Punching, (ii) Stacking factor , (iii) Check for Quality of Lamination Varnishing, Thickness & IR value Please note that CHP may be replaced with TC as these are in process test . Please review and confirm.	Kindly adhere to tender specifications.
20	IIIB (PTS)	Page-5-21	5.6.3	Design calculations	In present day system, all design calculation are conducted with the help of sophisticated software & computer programs. Hence it is not feasible to provide detail design calculations. However, copy of computer program outputs can be provided during detail design, if required. Please review and confirm.	Kindly adhere to tender specifications.
21	volume-4 (Tender drawings E&M)	SR.NO. 6	Drawing no. NHUR-I(II)-4CT-41-GA-044	Power house area caverns general arrangement section	In Power house cross section drawing, Generator barrel ID is given as 9400 mm. To provide sufficient working space inside generator barrel, recommended generator barrel ID is 10000 mm. Please review & confirm.	Kindly adhere to tender specifications.

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22	GENERAL			Evaluation of efficiency by summation of loss method	Since IEC-60034-2 is silent on losses to be included for calculation of efficiency. The same may be specified at this stage itself. As per standard practice , we suggest the following – 1. Windage loss at rated speed 2. Friction losses in upper & lower bearing of generator at rated speed. 3. Friction losses in thrust bearing attributable to generator rotor weight at rated speed. 4. Iron loss at rated voltage and frequency. 5. Stator copper losses at 75°c . 6. Stray load loss. 7. Field cu losses at 75°c. 8. Excitation equipment losses. Please confirm the inclusion of above in calculation of efficiency.	Kindly adhere to tender specifications.
23	GENERAL			Transport Limitations	Please furnish the transport limitation in term in maximum dimension (L x W x H) & weight of consignment.	Bidders are requested to ascertain themselves in regard to transportation limitation and maximum weight size for transportation .
24	GENERAL			Water Analysis report	Please furnish water analysis report.	Please refer Corrigendum No. 2
25	Volume-IIIB	7-2	7.2.1	Necessary cooling arrangement shall be provided for the busduct by the contractor according to the requirement.	Busduct shall be naturally cooled. No separate cooling arrangement shall be provided for busduct. Please review & confirm.	Kindly adhere to tender specifications.
26	Volume-IIIB	7-4	7.5.2	The degree of protection of enclosure shall be IP-55.	Degree of protection test (Air and water tightness test) shall be carried out as per appendix F of IS-8084. Please review & confirm.	Kindly adhere to tender specifications.
27	Volume IV, Sec-V	32 of 315	COOLING WATER SYSTEM FLOW DIAGRAM & Fire Fighting Scheme	Suction header for Fire Water Pump	We want to confirm that the fire water pump suction is being taken from the cooling water pump discharge header to fire water tank.(as per Cooling water scheme) Whereas scheme of fire fighting scheme, It is indicated from the draft tube of Unit 1&2. Suction for the Fire filling pump may please be clarified. Drawing may please be updated accordingly.	Please refer Corrigendum No. 2
28	Volume IV, Sec-V	32 of 315	Fire Fighting Scheme	Connection of Bore well to Fire water tank.	As the connection is being taken from the Draft tube of the Unit-1 & 2, separate provision of bore well and bore well pump is not required. Employer is requested to kindly review the requirement and delete.	Kindly adhere to tender specifications.
29	Volume IIIB, Section-29	143 of 274	29.2.1	The fire tank shall be placed approximately at EL. 1350.0 M (tentative) …….	Employer is requested to kindly confirm final elevation of the Fire Water Tank (proposed at 1350.0 M). A tentative elevation may necessitate the addition of an extra fire water pump for the plant. Please review and confirm.	This will be finalized as per site requirement however the approx tank EL is 1350
30	Volume IIIB, Section-29	150 of 274	29.5.6	Mechanical groove type coupling shall be provided for ease of dismantling of pipe & fittings which shall be finalised during detailed engineering.	We would like to clarify that mechanical grooved piping systems have not been provided as a standard practice for fire-fighting applications in India till date. Accordingly, it is proposed to provide flanged connections with break flanges for pipe-to-pipe joints to facilitate easy dismantling and maintenance. Please review & confirm.	Please refer Corrigendum No. 2
31	Volume IIIB, Section-29	143 of 274	29.1.3	One Set of Microprocessor based digital EPABX system for fire alarm system along with 30 nos. individual station distributed strategically throughout the plant.	Employer is requested to clarify that this system can be clubbed with plant EPABX telephone system As per 21.5.3 of specification for present application. Please review & confirm.	Kindly adhere to tender specifications.
32	Volume IV, Sec-V	32 of 315		Elevation of Potyard	We understand potyard elevation is 1291M. Please confirm.	Please refer tender dwg, EL of existing Potyard is EL 1306
33	Volume IV, Sec-V	32 of 315		Legible drawing	Employer is requested to provide Legible drawings as some drawing are not clear and difficult to read.	Please refer Corrigendum No. 2

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34	Volume I: Information for Bidders (IFB) Volume IIA: GCC	134 of 306 174 of 306	5 10	Location and Access: The Proposed construction sites are well connected with the access roads. Adit 1 to Adit 6 including Power House access tunnel are <500 m distance from the Srinagar – Uri National Highway (NH-1) and are approximately within 20km-25km distance from Quarry areas and facilities areas. Employer's Responsibilities	Since sufficient land is available in the project area, we request Employer to provide levelled & compacted land (approx 6000 sqm) for Storage of project materials free of cost. kindly review and confirm.	A patch of land is available near the powerhouse can be provided for E&M contractor store cum office. The said land shall be utilised initially for dumping facility and later on shall be made available to E&M Contractor for storage cum office facility. However, the said land shall be provided on chargeable basis as per the prevailing market rates.
35	Volume I: Information for Bidders (IFB)	134 of 306	7	Construction Power	We request Employer to provide 3 phase 415V power supply for construction power, free of cost at following locations: Power house, switchyard and other work areas. kindly review and confirm.	The Contractor has to arrange the construction power through state power distribution company at different locations. Alternately, DG back up power shall also be arranged by the Contractor.
36	Volume I: Information for Bidders (IFB)	137 of 306	12	Any other relevant information: The project has the availability of a residential colony in the project area at a distance of about 1 km from Adit 3. The Contractor can use the accommodation in the Colony after undertaking necessary renovation. On completion of the project, the contractor shall vacate the accommodation in a usable condition. The contractor will bear all charges including water, electricity etc. during the period of their use of the Colony premises.	We request Employer to provide this facility for our use free of cost without any rent. kindly review and confirm.	The Project has the availability of residential quarters at Bandi. The same can be provided as is where is basis to the E&M Contractor on chargeable basis as per the prevailing market rates. The renovation and maintenance required shall be made by the Contractor. Also, the security arrangement required, if any shall be arranged by the contractor itself.
37	Volume IIA: GCC	203 of 306	22.6	Site Clearance Clearance of Site after Completion: After Completion of all parts of the Facilities, the Contractor shall clear away and remove all wreckage, rubbish and debris of any kind from the Site, and shall leave the Site and Facilities in a clean and safe condition.	Clearance of Site after Completion: We understand that site clearance only for the materials supplied under E&M package is in the scope of present tender. Also, all the scrap materials generated during erection and commissioning and surplus materials left after completion of facilities shall be the property of contractor. We understand that surplus material (after completion of E&M works) supplied shall remain the property of E&M Contractor after completion of project. a) Kindly confirm that the ownership of surplus material which is with customer, which upon completion of works will be transferred to E&M Contractor free of cost. E&M Contractor shall be free to remove surplus material and take it away from the project site. b) Also E&M Contractor shall remain owner of packing material/containers (wooden/iron etc) and free to remove packing material and take it away from the project. kindly review and confirm.	Kindly adhere to tender specifications.
38	Section V: General Conditions of Contract (GCC)/PSNR	21 of 43	21.7	Watching and Lighting The Contractor shall provide and maintain at its own expense all lighting, fencing, and watching when and where necessary for the proper execution and the protection of the Facilities, or for the safety of the owners and occupiers of adjacent property and for the safety of the public.	We understand that Watching and lighting shall be required at E&M stores outside power house only. kindly review and confirm.	The watching and lighting of all the work areas including stores, passages, stairs etc and the areas declared as work areas by EIC shall be arranged by the contractor itself. For lighting, the power required shall be obtained from the state power distribution company. Further, watching shall also be come under the scope of contractor itself.
39	Volume-V (Forms & Procedures)	248 of 315	(C)'	The total adjustment (plus or minus) shall be subject to a ceiling amount of 25% of the Contract price during contractual completion period.	We request Employer to provide price variation without any ceiling . kindly review and confirm.	Kindly adhere to tender specifications.

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40	Volume I: Information for Bidders (IFB)	128 of 306	3	Implementation of the project and Contract Package: The Works of the project were awarded through different contract packages as detailed hereunder: (I) Package 1 : Civil Works under item rate contract (II) Package 2 : HM works under Single EPC Package (III) Package 3 : E&M works under single EPC Package	We understand that no civil works of any nature is in E&M package scope. kindly review and confirm.	Bid provisions are clear in this regard. Kindly adhere to tender specifications.
41	Volume III B (PTS)	12 of 37	2-5	2.2.4 Construction Methodology	Temporary crane available with civil agency shall be available to E&M bidder for installation of DT liner and embedements free of cost. kindly review and confirm.	Kindly adhere to tender specifications.
42	VOL-IIIB (PTS)	357/410	16.5.2.2	Power Cables- 1100 volt grade- These cables single or multicore (2/3/3.5/4 cores) shall be at least 1100Volt grade, heavy duty, FRLSH stranded Aluminum/ Copper conductor, XLPE insulation laid up, extruded PVC innershaeathed.	We understand that cable laid in cable trays shall be un-armoured and underground/outdoor cables shall have armouring. Please confirm.	Please refer Corrigendum No. 2
43	VOL-IIIB (PTS)	357/410	16.5.2.3	Control Cables- the control cables shall be atleast 1100 volt grade, multicore FRLSH type, colour coded/numbered, annealed stranded high conductivity Copper conductor insulated with Heat resisting PVC insulation PVC sheathed.	We understand that all Control cables shall be unarmoured. Please confirm.	Please refer Corrigendum No. 2
44	VOL-IIIB (PTS)	18-1	18.1.1.iv	Arrangement for neutral earthing and protection of the generator which shall include differential protection and stator earth fault protection.	Feasibility of providing Differential protection and Stator Earth Fault Protection shall be strictly as per standard design of Manufacturer. Kindly confirm acceptance.	Kindly adhere to tender specifications.
45	VOL-IIIB (PTS)	18-1	18.1.1.ix	All statutory compliance/certificates for Diesel storage and pollution control etc. for the operation of DG sets from the concerned authorities/ departments shall be obtained by the contractor in favour of Employer. For it, if any assistance required, shall be provided by the Employer.	All approval/clearance from CPCB/State pollution control board/Local bodies/Chief controller of Explosives (CCOE)/CEA/other licensing authorities etc. of the complete installation & operation of DG set shall not be in bidder's scope. However complete technical support shall be provided to Employer wherever required & deemed necessary. Kindly confirm acceptance.	Kindly adhere to tender specifications.
46	VOL-IIIB (PTS)	18-3	18.3.2	The engine shall be capable of delivering an output of 10% in excess of its rated output at its rated speed for a period of one hour in any period of 12 hours consecutive running, without undue heating of the engine or any other mechanical part.	Feasibility of provision for overspeed for a period of an hour in any 12 hours shall be strictly as per standard design of manufacturer. Kindly confirm acceptance.	Kindly adhere to tender specifications.
47	VOL-IIIB (PTS)	18-3	18.3.3	The governor shall have drooping characteristics to ensure proper load sharing.	Feasibility of provision for Speed droop in the Electronic Governor shall be strictly as per manufacturer standard. Kindly confirm acceptance.	Kindly adhere to tender specifications.
48	VOL-IIIB (PTS)	18-3	18.3.3	A over speed trip mechanism shall be provided to automatically shut off the supply of fuel in case the engine speed reaches 110 % of rated speed.	Feasibility of provision for overspeed trip mechanism shall be strictly as per standard design of manufacturer. Kindly confirm acceptance.	Kindly adhere to tender specifications.
49	VOL-IIIB (PTS)	18-4	18.3.5	The AVR for each generator shall be panel mounted where a control knob will be provided for control of voltage for synchronization and voltage raise/lower feature should be compatible with auto synchronizer for parallel operation.	Feasibility of provision for Control Knob for the purpose of Voltage raise/lower setting shall be strictly as per standard design of manufacturer. Kindly confirm acceptance.	Kindly adhere to tender specifications.
50	VOL-IIIB (PTS)	18-5	18.5.3.1	The unit shall start and build up voltage automatically within 10 seconds from getting command no volt signal to closing of 11KV breakers assigned for DG set.	Time for DG start & voltage build up shall be strictly as per standard design of manufacturer. Kindly confirm acceptance.	Kindly adhere to tender specifications.
51	VOL-IIIB (PTS)	18-5	18.5.3.2. iii)	Very high engine temperature	We understand that very high engine temperature is "very high water (Water jacket around engine) temperature ". Kindly confirm acceptance.	Kindly adhere to tender specifications.
52	VOL-IIIB (PTS)	18-5	18.5.3.2. v)	High oil temperature	Feasibility of provision for high oil temp. shall be strictly as per standard design of manufacturer. Kindly confirm acceptance.	Kindly adhere to tender specifications.
53	VOL-IIIB (PTS)	18-5, 18-6	18.5.3.2. vii) to xi)	Over crank (failed to start), Differential protection, very high winding temp. & Restricted E/F	Feasibility of provision for Over cranking, Differential protection, very high winding temp. and Restricted Earth fault protection shall be strictly as per standard design of manufacturer. Kindly confirm acceptance.	Kindly adhere to tender specifications.
54	VOL-IIIB (PTS)	18-6	18.5.3.3	Alarms	Feasibility of provision of Alarms shall be strictly as per standard design of manufacturer. Kindly confirm acceptance.	Kindly adhere to tender specifications.
55	VOL-IIIB (PTS)	18-6	18.5.4	Once the dehumidification unit is switched 'ON', it shall be controlled automatically with a thermostat.	Feasibility of provision for thermostat for the purpose of demudification arrangement shall be strictly as per standard design of manufacturer. Kindly confirm acceptance.	Kindly adhere to tender specifications.

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56	VOL-IIIB (PTS)	18-7	18.5.6.v)	The height of the chimney shall be as per latest national guidelines.	Height of the chimney shall be as per CPCB/State pollution guidelines. Kindly confirm acceptance.	Kindly adhere to tender specifications.
57	VOL-IIIB (PTS)	18-7	18.5.6.xi)	Starting batteries shall not be less than 300 AH rating for Power House DG & 150 AH for other DG set or as per manufacturer recommendation based on load calculations.	The battery size should be as per DG set manufacturer standard practice for meeting starting cycle as per specification . Kindly confirm acceptance.	Kindly adhere to tender specifications.
58	VOL-IIIB (PTS)	18-8	18.5.7	Control, Protection & Alarm-Annunciation panel	Feasibility to provide the type of arrangement regarding Control and Alarm annunciation shall be strictly as per standard design of manufacturer. Kindly confirm acceptance.	Kindly adhere to tender specifications.
59	VOL-IIIB (PTS)	18-8	18.5.7 .vi)	All protection equipment i.e., Differential protection relay, Restricted earth fault, reverse power relay, under voltage relay,frequency relay, instantaneous and IDMT over current relay, earth fault relay etc. and other relays to satisfy the requirement of the clause 18.5.3.2 “Automatic shutdown” of this section.	Feasibility of provision for Differential relay & Earth fault protection shall be strictly as per standard design of manufacturer.Kindly confirm acceptance.	Kindly adhere to tender specifications.
60	VOL-IIIB (PTS)	18-9	18.5.8.B)	In test mode it shall be possible to manually start the diesel generator directly. Then the automatic starting sequence is energized and the generator synchronized to the energized main bus.	Synchronization of both 1000KVA DG sets shall be achieved through synchronizing panel placed in the DG room. Kindly clarify/confirm.	Kindly adhere to tender specifications.
61	Vol-III B	19-3	19.2.1	The 415V sides of SSTs shall be connected to SSBs through LT Power cable/bus. The 415V sides of UATs shall be connected to respective UABs through LT ducts/cables as per requirement of layout.	We are considering LT power cable for connection between SSTs to SSBs and UATs to UABs. Kindly confirm acceptance.	Kindly adhere to tender specifications.
62	Vol-III B	19-4	19.2.1	In case, Motor Control centers (MCC) are provided, the same shall be placed at generator floor.	Instead of MCC, standalone starter panel shall be provided for Unit & Common auxiliaries of Generator and Turbine. Kindly confirm acceptance.	Kindly adhere to tender specifications.
63	Vol-III B	19-16	19.5.9.1	The bus-bar in the LV bus-duct shall be Copper/ Aluminum 415V, 3-Ph, 4 wire, 50 Hz, self cooled compact sandwich type.	In case LV bus-duct is mandatory for interconnection between SSTs to SSBs and UATs to UABs, Aluminum bus-duct shall be considered. Kindly confirm acceptance.	Kindly adhere to tender specifications.
64	Vol-III B	3-22	3.5.7.3	Oil Pumps - Motor starter shall be equipped with variable frequency drive for soft starting.	VFD function is not required (also not advisable) for Governor OPU system/drainage/CW system. As such, soft starter shall be provided for motor ratings above 50kW. Kindly confirm.	Kindly adhere to tender specifications.
65	Volume-IIIB (PTS) – Turbine and Accessories	2-6	2.3.3	Pressure rise and speed rise: - Pressure rise-23% of static head	As per IS 12837:1989 For V. Francis turbine Pressure rise is 30-35%, Please review and clarify.	Please refer Corrigendum No. 2
66	Volume-IIIB (PTS) – Digital Governing system and Accessories	3-5	3.2.10.2	Emergency shutdown scheme: - The emergency closing circuit shall have two number solenoid valves to ensure redundancy in emergency closing operation.	As per standard practice, the emergency closing circuit shall have one number solenoid valve to ensure in emergency closing operation. It is to be noted that as per our Hydraulic Scheme, hydraulic valves for normal closing and emergency closing are independent of each other. During emergency closing, the valves used for normal closing are completely blocked and do not come into operation. In view of above two nos. of solenoid for redundancy in emergency closing operation is not required. Kindly confirm acceptance.	Kindly adhere to tender specifications.
67	Volume-IIIB (PTS) – Digital Governing system and Accessories	3-16	3.5.4.5	Control and Indication – 4) Indicating lights - The following indicating lights shall be mounted on the front face of the local cabinet / Unit control boards i) Servomotor gate lock ‘on’ or off indication ii) Generator brake switch in ‘Auto’ position. iii) Generator brake ‘on’ or ‘off’ indication iv) Actuator lock ‘on’ v) Auto/ manual, light on indicate, “auto” or “manual” vi) Speed failure indication light vii) Governor electronic power supply test and failure indication viii) Inlet valve position, full open and full closed positions.	The indicating lights shall be mounted on various panels as per their system application as under; (i) Servomotor gate lock indication – UCB (ii) Generator brake switch in auto position- UCB (iii) Gen brake on/off indication – UCB (iv) Actuator lock ‘on’ – Not Applicable (v) Auto / Manual indication – EHGC (Governor Electronic Panel) (vi) Speed sensor failure indication – EHGC (Governor Electronic Panel) (vii) Gov. fault indication – EHGC (Governor Electronic Panel) (viii) Gov. power supply fail indication- EHGC (Governor Electronic Panel) (ix) Inlet valve position – UCB Kindly review and confirm.	Kindly adhere to tender specifications.

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68	Volume-IIIB (PTS) – Digital Governing system and Accessories	3-17	3.5.4.5	E) In addition to above, the following controls & instruments shall also be including in the governing system 1) Gate position & gate limit control and indication A mechanical gate limit indicator and gate position indicator shall be provided on local control panel. These indicators shall be designed for field adjustment to obtain correct indication of turbine gate position.	As per standard design practice, we propose that Gate position indicator shall be provided on Local control panel (HMC panel) and Gate Limit indicator shall be provided in HMI (of EHGC panel). Kindly review and confirm.	Kindly adhere to tender specifications.
69	Volume-IIIB (PTS) – Digital Governing system and Accessories	3-20	3.5.6	3.5.6 Guide vane control hydraulic assembly The guide vane control hydraulic assembly includes actuator (proportional valve), associated valves, emergency shutdown valve and 2nd closure time control valve mounted on a single manifold to form a complete and operational hydraulic control system for interfacing with the digital servo position controller.	We propose hydraulic control assembly for guide vane control, having servo valve, associated valve, emergency shutdown valve only. As per our design of hydraulic control, second closure time control is part of servomotor and its piping. Kindly accept and confirm.	Kindly adhere to tender specifications.
70	Uri HEP Volume-IIIB (PTS) – Digital Governing system and Accessories	3-21	3.5.7	Oil Pressure system: - The oil pressure system shall consist of a sump tank, two (2) A.C. motor driven screw / vane /gear pumps and one jockey pump of suitable capacity, if required and pipes, fittings etc.	In addition to screw/gear/vane pumps, we propose piston/axial type pumps also. Kindly accept and confirm.	Kindly adhere to tender specifications.
71	Volume-IIIB (PTS) – Digital Governing system and Accessories	3-24	3.5.7.4 (A)	Proportional valve oil filtering – Filter elements used shall be cleanable with petrol.	Only return line filter element (40/50-micron capacity) for PP Set shall be of cleanable type. Pressure filter element (10-micron capacity) provided in the Governor Hydro-mechanical Cabinet shall not be re-usable type. Filter manufacturers offer filer elements as stated above. Kindly accept and confirm.	Kindly adhere to tender specifications.
72	Volume-IIIB (PTS) – Main Inlet Valve and Accessories	4-12	4.5.11.1	Oil Pressure System-General: - The oil pressure system shall consist of a sump tank, two (2) A.C. motor driven screw / vane /gear pumps of suitable capacity, pipes, fittings etc.	In addition to screw / gear / vane pumps, we propose piston / axial type pumps also. Kindly accept and confirm.	Kindly adhere to tender specifications.
73	Volume-IIIB (PTS) – Main Inlet Valve and Accessories	4-22	4.8	Spare Parts: - 21. Transducers assemblies complete of all type used in the system	These items are not applicable in control mechanism of MIV. Kindly review and confirm.	Kindly adhere to tender specifications.
74	Volume-IIIB (PTS) – Oil Handling System	30-3	30.3.2	Lubrication oil handling system: - The purifier shall be capable of processing the lubricating oil on not more than two (2) passes basis.	Lubrication oil purifying plant cannot bring down the moisture content in the range of 50 ppm in 2 passes. It should be allowed in multiple passes. Kindly review and confirm.	Kindly adhere to tender specifications.
75	VOL-IIIB (PTS)/SCADA	14(47)	14.8	Spares List	The specified spares list is duplicated/ repeated at page no. 14-48 of Vol-IIIB(SCADA). We understand that only one list need to be proposed. Please amend the specification accordingly.	Please refer page numbers, list is not duplicated . Also refer Corrigendum No.02
76	VOL-V/ATTACHMENT-5 (List of approved subcontractors/ Vendors)	7 of 30	5.7	Vibration Monitoring System	Please add BHEL as a vendor for Vibration monitoring System	Kindly adhere to tender specifications.
77	VOL-V/ATTACHMENT-5 (List of approved subcontractors/ Vendors)			Sub-Vendor criteria & Approved Sub-vendor list	During procurement of the items through GeM (Govt. E-marketplace), if offers received from additional vendors (other than List of approved vendors mentioned in tender documents) and complying to the relevant technical specification, the same shall be submitted to Employer along with credential for approval during Detailed engineering. In view of above, Employer is requested to allow for approval of additional vendors on submission and review of valid credentials. Please confirm.	Bid provisions are clear in this regard.
78	0, ITB	11.4, e		All applicable taxes, duties, other levies and charges etc. on Price Schedule 1, 2 and 3 in respect of direct transaction between the Employer and the Contractor as applicable, in Employer's country as of twenty eight (28)days prior to deadline for submission of bids shall be included in Ex- Works prices, Local Transportation charges and Model Test & Installation Services.	In GST regime, taxes and duties are applicable on all transactions. We understand that taxes and duties on total amount to be considered for amount as appearing in Schedule 1,2 and 3. Kindly confirm that in Price schedule 6 and 7, prices to be quoted incl. taxes.	Bid conditions are clear in this regard. Please adhere to bid specifications.
79	0, ITB	11.4, f		All applicable taxes/ duties including GST as applicable and assessed on the Employer shall also be included in the Prices/ Rates in Price Schedule 2 & 3, which shall be deducted from the Contractor and deposited to the concerned authority by the Employer.	We understand that GST shall be applicable on supply/ services rendered by Contractor and further no tax shall be assessed on Contractor. Kindly confirm.	Bid conditions are clear in this regard. Please adhere to bid specifications.

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80	0, ITBV, Forms and Procedures	12, c Appendix 3, Insurance Requirements		Insurance should be taken in INR and the contractor must ensure that Insurance is taken for complete scope of work mentioned in Appendix-3 and it should not be under insured at any instant during pendency of the Contract insurance requirements.	In present scenario, it is difficult to get insurance in Hydro Projects. Since Employer is having existing plant i.e. Uri-I Stage-I and might be taking insurance policy for existing plant. In view of above, It would be easy for Employer to arrange Insurance for Uri-I Stage-II Project also. In view of above, Employer is requested to include Insurance in their scope for E&M Works.	Please adhere to bid specifications. Also refer Corrigendum No. 02 i.r.o EAR insurance.
81	I, IFB	19		Construction Schedule:i) Project completion period is 44 months from project zero date (Project zero date: Date of award of civil works).ii) The E&M package works shall commence after 6 months from award of civil package.iii) The total time period for E&M works is 38 months.iv) Time duration of activities is shown from Project Zero date, E&M Contractor may modify duration to match 38 months schedule.	Completion period for E&M works envisaged is 38 months and E&M package shall commence 6 months after award of civil package. Accordingly, Employer is requested to indicate date of Award of Civil works for the project. This will help us to plan our bid and further activities in the Construction schedule.	Please adhere to bid specifications.
82	V, Forms & Procedures	Appendix -1, Terms of Payment, Price schedule no. 1		Five percent (5%) of the total EXW amount (as per Price Schedule No.1) as an interest bearing advance payment, if opted for, against receipt of invoice, Performance Security and an irrevocable Advance Payment Security equivalent to 110% of advance amount made out in favour of the Employer.	Employer is requested to kindly arrange to release 10% interest free advance on submission of Bank Guarantee for equivalent amount.	Please adhere to bid specifications.
83	V, Forms & Procedures	Appendix -1, Terms of Payment, Price schedule no. 1		75% of the total or pro rata EXW amount and price variations, if any, (as per Price Schedule No.1) upon dispatch. The pro rata recovery/adjustment of advance along with interest shall be made at this stage.	We understand that 75% of EXW amount and 100% price variation amount along with 100% applicable taxes and duties shall be released by Employer on dispatch of items. Kindly confirm.	Please adhere to bid specifications.
84	V, Forms & Procedures	Appendix -1, Terms of Payment, Price schedule no. 3		99% Payment (as per Price Schedule No.3) against Model Testing and submission of test report shall be released after successful completion of model testing and acceptance of the Model Test report by the Employer. The price adjustment shall not be applicable for this payment.	Employer is requested to allow price adjustment on Model testing price also as same involves procurement of material and labour during preparation of model and conductance of model.	Please adhere to bid specifications.
85	V, Forms & Procedures	Appendix -1, Terms of Payment, Price schedule no. 3		Ninety percent (90%) (as per Price Schedule No.3), of the measured value of work performed by the Contractor, as identified in the said Program of Performance, during the preceding month, as evidenced by the Employer's authorization of the Contractor's application, will be made monthly. Price variation, if any, shall be payable at this stage.	Employer is requested for 10% interest free payment on mobilization of Contractor at site and 80% on performance of work. We understand that 100% price adjustment along with 100% taxes shall be payable along with payment on monthly performance of work. Kindly confirm.	Please adhere to bid specifications.
86	V, Forms & Procedures	Appendix -1, Terms of Payment		5% payment of the contract price of each bill/ invoice raised against Price Schedule No. 1, Price Schedule No. 2, Price Schedule No. 3 above shall be deducted and kept as a security deposit. The above deducted amount shall be released after satisfactory completion of Defect Liability Period. The above deducted amount, if so desired by the Contractor during execution of contract may be released on submission of Bank Guarantee (BG) of equal amount.	As Contractor shall be submitting performance guarantee equivalent to 5% of Contract Price, Employer is requested not to deduct 5% payment from each bill in Price schedule 1,2 and 3 as 5% security deposit is already available with Employer.	Please adhere to bid specification.
87	V, Forms & Procedures	Appendix -2, Price adjustment		The total adjustment (plus or minus) shall be subject to a ceiling amount of 25% of the Contract price during contractual completion period.	In current scenario, it is difficult to ascertain future prices. In view of practice being followed in Hydro tenders, Employer is requested to remove ceiling on price adjustment for E&M works.	Please adhere to bid specifications.
88	General	---		---	We understand that following Bid Document:a) Tender documents (Vol-0, I, II, IIIA, IIIB, IIIC, IIID, IV & V)b) Corrigendums/ Clarifications/ Replies to queries issued by M/s CVPPPL, after the Pre bid meeting are not required to be submitted Online/ Offline. Please confirm our understanding.	NA
89	NIT	1.2 (vii)		On line bid submission end date & time: 25/07/2025, 18:00 hrs. (IST)	We request Employer to extend date of submission of bid by 6-8 weeks after issuing pre-bid clarifications on pre-bid queries raised by bidders. Kindly consider.	Please adhere to bid specifications.
90	NIT	1.1 (vii)		Earnest Money Deposit: INR 4.90 Cr.	We request Employer to accept Corporate Guarantee for similar amount in lieu of Bank Guarantee on account of Bid Security.	Please adhere to bid specifications.
91	Vol-0 (ITB)	13		Bid Security		

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/Clarifications
92	Vol-0 (ITB)	11.4		Bid Prices	We understand that Price to be quoted in price schedules is inclusive of taxes and duties which includes prices as appearing in Price schedule 4 (sum of Price schedule 1,2 and 3). In case of milestone payment in Schedule 1,2,3 kindly confirm that the payment shall be released including taxes and duties or excl. taxes and duties. Employer is requested to provide separate schedule for taxes and duties for clear segregation of basic price and taxes and duties. Kindly confirm that Contract price shall be inclusive or exclusive of taxes and duties.	Please adhere to bid specifications.
93	Vol-0 (ITB)	25.3.e		Work, services, Facilities etc., to be provided by the Employer Where bids include the undertaking of work or the provision of services or Facilities by the Employer in excess of the provisions allowed for in the bidding documents, the Employer shall assess the costs of such additional work, services and/or Facilities during the duration of the contract. Such costs shall be added to the bid price for evaluation.	1. We request Employer to provide the list of additional work, services and/or Facilities to be considered by bidder in their bid to enable all bidder at par.2. Employer shall only be responsible to complete the work i.e. additional work, services and/or Facilities under this heading at the cost being added by Employer to the bid price for evaluation. Any kind of liability arising from this work shall be to Employer's account. Kindly confirm.	Please read with ITB Cl. No. 25.2. Please adhere to bid specifications.
94	Vol. V(Forms & Procedures), Appendix -8	4.3		Limitation of Liability Subject to para 4.2 above, the Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantees shall not exceed twenty five percent (25 %) of the Contract price.	As per tender condition, LD due to delay and performance is applicable on contract price. Taxes & duties are the levy of Govt. and are paid to Govt. Accordingly, Employer is requested to consider Contract Price excluding taxes and duties for calculating liquidated damages for performance and delay.	Please adhere to bid specifications.
95	Vol. II A(GCC)	26.2		Completion time Guarantee If the Contractor fails to attain Completion of the Facilities including taking over or any part thereof within the Time for Completion or any extension thereof under GCC Clause 40 (Extension of Time for Completion), the Contractor shall pay to the Employer liquidated damages in the amount.	Further, as per Circular No. 178/10/2022-GST dated 03-08-2022 issued by Dept. of revenue, MoF, Govt. of India, in case of liquidated damages, penalty etc are levied on Contractor then Taxes & duties including GST will not be applicable. We request Employer to review and modify the clause accordingly.	Please adhere to bid specifications. Also refer Corrigendum No. 02 for clarity.
96	Vol-IIA (GCC)	14.1		14. Taxes and Duties 14.1 Except as otherwise specifically provided in the Contract, the Contractor shall bear and pay all taxes, duties, levies and charges assessed on the Contractor, its Subcontractors or their employees by all municipal, state or national government authorities in connection with the Facilities in and outside of the country where the Site is located.	Employer is requested to kindly confirm applicability of taxes & duties in addition to GST or any tax concession available in UT of J & K for the project.	Bid specifications are quite clear. Bidders are requested to ascertain themselves.
97	Vol-0 (ITB)	25.2 (d)		the extra cost of work, services, Facilities etc., required to be provided by the Employer or third parties.	Employer is requested to provide details of extra work, services, facilities required to be provided by the Employer or third parties so that all bidder are at par during commercial evaluation.	Please adhere to bid specifications.
98	Vol-0 (ITB)	29.3		29. Award Criteria 29.3 The Employer reserves the right to vary the quantity of any of the spares and/or delete any items of spares altogether at the time of Award of Contract.	We understand that in case of any addition to the items/equipment & spares beyond the scope envisaged in the tender documents at the time of Award of Contract, Contract Price shall be revised due to variation in quantity of items / spares. Kindly confirm.	Please adhere to bid specifications.
99	Vol-IIIB	1.5.1.6		Transportation limitations:For shipments, the Manufacturer shall pack the items to meet size and weight restrictions of the Indian railways and road systems	We request Employer to provide transport limits of heavy consignment in respect of weight (in Ton) and length, width & height (L x W x H).	Please refer Corrigendum No. 2
100	Vol-IIA (GCC)	35.1 (d)		Unforeseen Conditions the additional cost and expense that the Contractor is likely to incur as per Annex-A to this GCC.	Annexure A referred in clause is on account of idling of resources. In case any changes are required due to unforeseen conditions beyond idling claims, we understand that same shall be dealt as per Cl. 39 of GCC (Change of Facilities). Kindly confirm.	Please adhere to bid specifications.
101	Vol-V	Appendix 2		Appendix 2. Price Adjustment 1. Price Adjustment Formula for Supply of Plant and EquipmentP1 = PO x {0.20 + 0.35 (L1/L0) + 0.45 (M1/M0) – PO	We request Employer to review fix component mentioned in Price adjustment formula. We understand that fixed component in the formula is derived based on advance to be availed by contractor and Employer intends not to pay variation on advance availed by Contractor. In view of above, we request employer to consider fixed component as 0.05 in place of 0.20.	Please adhere to bid specifications.
102	Vol-IIB (SCC)	7		Warranty and Liability of Software	As per general practice the Warranty and Liability of Software is not covered in the scope of Contract. Employer is requested to kindly review and delete the scope covered under this clause.	Please adhere to bid specifications.
103	Vol-IIA (GCC)	32		Care of Facilities	In the event that project is delayed beyond the original contract completion period, Employer shall take over the spares supplied for the project. Kindly confirm.	Please adhere to bid specifications.

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104	Vol-IIA (GCC)	26.2		If the Contractor fails to attain Completion of the Facilities or any part thereof within the Time for Completion or any extension thereof under GCC Clause 40 (Extension of Time for Completion), the Contractor shall pay to the Employer liquidated damages in the amount computed @ zero-point two five percent (0.25%) of the Contract price per week per unit. The aggregate amount of such liquidated damages shall in no event exceed the ten (10 %) of the Contract price. Once the "Maximum" is reached, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 42.2.2.	The rate of computation of liquidated damages is very much on the higher side. Employer is requested to review the same.	Please adhere to bid specifications.
105	Vol-IIB (SCC)	18		GCC Clause 27 Defect LiabilityGCC Clause 27.7 is deleted and substituted by the following:……For the remaining period of Defect Liability Period the above manpower shall be reviewed and finalized by the Engineer-in-charge for any replacement/ alterations.	The requirement of clause shall result in idling of Manpower. Employer is requested not to insist on this clause. Bidder shall depute their representative expeditiously to attend the problem as per requirement at site. Kindly accept.	Please adhere to bid specifications.
106	Vol-V Appendix-1	3.3		Terms and Procedures of Payment	We understand that all payments for Price Schedule 1,2 and 3 except interest bearing advance payment shall be released by Employer through irrevocable LC to be opened by Employer. Kindly confirm.	Bid specifications are quite clear . Please adhere to bid specifications.

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/Clarifications
107	Vol-II B (SCC)	22		Penalty on account of non-attendance of fault in control, monitoring and SCADA system	We request Employer not to insist for this clause. Employer is requested to suitably deploy their skilled manpower for handling such exigencies. However, if EMPLOYER desires to keep / retain this clause then we request Employer to modify the clause such that penalty so imposed on Contractor for not attending the faults in Control, Monitoring and SCADA System shall be based on Ex-works value / amount allocated for Control, Monitoring and SCADA System only (i.e. unit wise) and not imposed on the Contract value. Kindly confirm.In the event Employer insists on retaining clause 14.4.1 (PTS), we request EMPLOYER to keep total of LD (liquidated damages) due to delay under clause 26.2 (GCC) plus Penalty under clause 14.4.1 (PTS) at 10% of the Contract Price. Kindly confirm.	Kindly adhere to tender specifications
108	Vol-3B (PTS)	14.4.1		Penalty During the period of availability of expert as defined in Clause 14.1.10. (iii) penalty shall be imposed for every incidence of fault related to control, monitoring and SCADA if not attended within 3 hours after occurrence of the fault specifically for running of each unit. The record of such incidences after 45 days from commissioning of each unit shall be maintained by the project. An amount equal to 0.01% for each event of each unit subject to maximum of 0.5% of contract value shall be levied as penalty. Availability of expert(s) for one year from date of commissioning of last unit to ensure applicability of clause no 14.4.1.		Kindly adhere to tender specifications
109	Vol-3B (PTS)	14.1.9 (iii)		Availability of expert(s) for one year from date of commissioning of last unit to ensure applicability of clause no 14.4.1.		Kindly adhere to tender specifications
110	Vol -2A (GCC)	26.2		….The aggregate amount of such liquidated damages shall in no event exceed the ten (10 %) of the Contract price…..		Kindly adhere to tender specifications
111	Vol-IIIB (GTR)	1.1		Training	Employer is requested to confirm the man-months for which training of engineers of Employer is required. The training will be provided at Contractor's manufacturing works/ Project Site. Kindly confirm that no refund shall be provided to Employer if training not availed by Employer.	Kindly adhere to tender specifications The proposed training for various equipment and systems shall be minimum 30 man-months. Please refer GTR clause 1.10.2.1
112	Vol-IIB (SCC)	6.11		The prices of all future requirements of item of spares beyond 3 years' operational requirement will be derived from the corresponding ex-works price at which the order for such spares have been placed by Employer as a part of Specified spares or Recommended spares. Ex-works order price of future spares shall be computed in accordance with the price adjustment provisions covered under the main Contract with base indices mentioned therein and there will be no ceiling on the amount of variation in the prices. The above option for procuring future recommended spares by the Employer shall remain valid for the period of 5 years from the date of successful completion of Commissioning of the equipment.	The future requirements of item of spares beyond 3 years' operational requirement is additional to existing contract. Also, provision of price adjustment available in the contract is to mitigate to some extent the increase in prices of items / materials covered in the scope of E&M Bidder during contract period. Price adjustment does not reimburse the increase of actual cost of material / item. Therefore, we request Employer not to link price of long-term spares with price adjustment provided in the tender. In future, if recommended spare parts are required by Employer, fresh prices shall be mutually agreed. Please confirm.	Please adhere to bid specifications.
113	Vol-V	Appendix 1		Schedule No. 3. Model Test and Installation Services: 99% Payment (as per Price Schedule No.3) against Model Testing and submission of test report shall be released after successful completion of model testing and acceptance of the Model Test report by the Employer. The price adjustment shall not be applicable for this payment.	As the model for the test is to be manufactured, we request Employer to release 100% payment against Model Testing. Further, in view of manufacturing of the model for Model Test, price adjustment shall be applicable. Contractor shall claim the price adjustment, if any, towards Model Test after successful completion of Model Test and submission of test report. Kindly confirm.	Please adhere to bid specifications.
114	VOL-IIIB (PTS)/SCADA	14.1.2/x14.1.5		ADSS Optic Fiber Cables between Uri-I stage-II and Admin Building at Colony	Employer is requested to clarify supply / laying of ADSS cables between Uri-I stage-II and Admin Building at Colony shall be in the scope of bidder or employer.In case same is in the scope of bidder, kindly furnish cable route lengths between these two locations and whether cables will be laid over ground or Underground.	Bid provisions are clear. Laying of ADSS cables between Uri-I stage-II and Admin Building at Colony shall be in the scope of bidder. Cables will be laid over ground. Refer layout dwgs for approx route length.
115	VOL-IIIB (PTS)/SCADA	14.1.2/xv14.1.4		Data Transmission form Uri-I stage-II to Central Control Room at Corporate through Optic Fiber Cables/ ADSS	Employer is requested to clarify supply / laying of Optic ADSS cables between Uri-I stage-II and Central Control room at Corporate shall be in the scope of bidder or employer.In case same is in the scope of bidder, kindly furnish cable route lengths between these two locations and whether cables will be laid over ground or Underground.	Tender provisions are clear in this regard.

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116	VOL-IIIB (PTS)/SCADA	14.1.2/xvi		Communication media between Uri-I stage-I and Uri-I stage-II Power House	Employer is requested to clarify communication between Uri-I stage-I and Uri-I Stage-II shall be in the scope of bidder or employer.In case same is in the scope of bidder, kindly furnish cable route lengths between these two locations and whether cables will be laid over ground or Underground.	Tender provisions are clear . Optical fiber cable shall be laid between two power houses . Cables will be laid to suit site. Refer layout dwgs for approx route length.
117	VOL-IIIB (PTS)/SCADA	14.2.2/B14.2.3		OFC between Uri-I stage-II and Dam	Employer is requested to clarify OFC between Uri-I stage-I and Dam shall be in the scope of bidder or employer.In case same is in the scope of bidder, kindly furnish cable route lengths between these two locations and whether cables will be laid over ground or Underground.	OFC between Uri-I stage-I and Dam is not in scope
118	VOL-IIIB (PTS)	14.1.5		ADSS optical fibre link shall be provided for connection between Power House and administrating building.	Employer is requested to provide route length between Power House and administrating building.	Tender provisions are clear in this regard.
119	VOL III B GTR	1-20		Creation of warehouse facility	Employer is requested to kindly remove this requirement from scope of E&M works and may be included in Civil works scope as nature of works is related to civil works. Kindly accept and confirm.	Kindly adhere to tender specifications.
120	VOL III B	177/410		Online Partial discharge system as per clause no 8.1.1 (V & X) of VOL IIIB PTS	Online partial discharge system is mentioned in two clauses. Accordingly we understand that Online partial discharge system for transformer tank & HV bushing to be provided. Online tan delta & capacitance for HV bushing to be provided. Kindly confirm.	Tender Provisions are clear
121	VOL III B	180/410		Oil to Oil bushing at HV side as per clause no 11(a) of 8.3 of VOL IIIB PTS & OIL to SF6 Bushing at HV Side as per sl no 22.1 of technical data sheet of GSU Trfr of VOL III C	We understand that OIL/SF6 bushing shall be given, since HV side shall be connected to GIS. Kindly confirm.	Please refer Corrigendum No 2
122	VOL III B	184/410		HV , LV & Neutral Bushing as per clause no 8.5.4.1 of VOL IIIB PTS	HV Bushing shall be RIP/RIS with Polymer housing. LV & Neutral bushing shall be Oil communicating porcelain type. Kindly accept and confirm.	Please refer Corrigendum No 2
123	VOL III B	184/410		Differential pressure gauge as per clause no 8.5.8.1 (II) of VOL IIIB PTS	Differential pressure gauge is provided in cooler to detect mixing of water in oil in case of a leakage. In the double tube cooler, water does not get mixed with oil due to leakage, instead the leaked water is collected separately to give alarm and as such differential pressure gauge is not required for double tube cooler. Kindly accept and confirm.	Kindly adhere to tender specifications.
124	VOL III B	191/410		SS Valve as per Cause no 8.5.13 of VOL IIIB PTS	All Valve Upto 50 NB, Gun Metal valve shall be provided. Above 50 NB, Cast Iron with Gun Metal fitting valve shall be provided. Kindly accept and confirm.	Please refer Corrigendum No 2
125	VOL III B	194/410		On line Moisture & dissolved gas analyser as per clause no 8.5.21.1 (XXVIII) of VOL IIIB PTS	Single system Online DGA with Moisture detector shall be provided. Kindly confirm.	Kindly adhere to tender specifications.
126	VOL III B	195/410		Controller for Direct Hot Spot Temperature Measurement System as per Clause no 8.5.21.2 of VOL IIIB PTS	8 Channel controllers shall be provided with 8 no of fibre optic sensor along with controller to measure atleast 4 no of sensors simultaneously as per specification. Kindly confirm.	Kindly adhere to tender specifications.
127	VOL III B	199/410		Transformer Mineral Oil as per clause no 8.5.24 of VOL IIIB PTS	Transformer mineral oil shall be supplied as per IEC 60296. All characteristics will be as per IEC 60296. Kindly accept and confirm..	Kindly adhere to tender specifications.
128	VOL V	66/315		Vendor List for Moisture Detector & Online DGA as per 8.13 & 8.14 of attachment 5 of VOL V	BHEL, ROBERTSHAW, ONIX INSTRUMENTS, MAPE, NEDERMAN, SART, WAISALA & ENDRESS+HAUSER don't provide online DGA with Moisture detector. Employer is requested to consider MTE INDIA PVT LTD/ QUALITROL/NV SUBPOWER for supply of online DGA with Moisture Detector. Kindly accept and confirm.	Please refer Corrigendum No 2
129	VOL V	66/315		Vendor List for Aircell as per 8.11 of attachment 5 of VOL V	Unirub & Sukrut both are different companies. BHEL understands that both are applicable to supply aircell. Kindly confirm	Please refer Corrigendum No 2
130	VOL III B	177/410		One set of rail as per clause no 8.1.1 (III) of VOL IIIB PTS	Please specify the length of Rail.	Please refer layout drawings
131	VOL III B	203/410		Spare Parts-Vacuum gauge & differential pressure gauge as per sl no 17 & 18 of clause no 8.8 of VOL IIIB PTS	These spare parts are not required as these items are not used in transformer. Employer is requested to kindly remove this requirement.	Kindly adhere to tender specifications.
132	VOL V	66/315		Vendor List for Oil pumps as per 8.3 of attachment 5 of VOL V	Best & Crompton don't provide Oil Pump. Employer is requested to consider other vendors like NXL Flow Instruments & Flow Oil Pumps Pvt Ltd also. Kindly accept and confirm.	Please refer Corrigendum No 2
133	VOL V	66/315		Vendor List for Bushing as per 8.5 of attachment 5 of VOL V	BHEL/CGL/Aditya Birla Insulator/Jai shree insulator/Modern Insulator don't provide RIP/RIS Bushing. Kindly consider other approved Vendors also.	Please refer Corrigendum No 2
134	VOL III B	191/410		Neutral Formation as per Clause No 8.5.12 of VOL IIIB PTS	Employer is requested to consider Copper BUS bar also for Neutral formation. Kindly accept and confirm.	Kindly adhere to tender specifications.
135	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.1.1 (i)	Two (2) sets of Fresh air blowers of 100% capacity each (one unit serves as standby) including filters, enclosures etc. for supply of fresh air to the entire system, to be located at the Ventilation tunnel portal.	1. Please confirm if Fresh air blowers shall be common for both the cavern Power House as well as Transformer cum GIS cavern. 2. Please confirm the location of these fresh air blowers, shall be at EL 1291.90 at portal of vertical shaft or at outside portal of already existing Cable Cum Ventilation Tunnel for URI I HE Project. 3. If location is outside already existing Cable Cum Ventilation Tunnel for URI I HE Project, then please provide the length of same. 4. Kindly confirm if the supply air from Fresh Alr Blowers to AHUs of respective cavern shall be ducted or not.	1. Confirmed 2.Kindly Refer the layout drawings 3. Kindly Refer the layout drawings. 4. Kindly adhere to tender specifications.
	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.2.1	Fresh Air Blowers - location Ventilation tunnel portal - Fresh Air for all areas i.e. power house, control block, Transformer Cavern, bus duct galleries, cable tunnel, escape gallery etc.		

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/Clarifications
136	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.1.1 (ii)	Required Sets of Air handling units, each of them of 100 % of the required capacity (one unit serves as standby) for the area designated in power house floors, control block, service bay, main access tunnel and bus duct gallery Transformer Cavern, escape gallery and cable tunnel etc.	1. It is understood that AHU(s) for Transformer cavern area and Power house area shall be different and separate. Therefore, AHU/HVAC Room is required for these AHUs in Transformer cum GIS Cavern. 2. It is proposed to give multiple number of AHU along the transformer/ Power house area with 1 no. unit as Standby for Each area i.e., (N+1) redundancy. Similar philosophy has been adopted for Dibang HEP . Kindly accept.	Kindly adhere to tender specifications
	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.2.1	AHUs - location As per site suitability - for Power house floors, control block, bus duct galleries, drainage gallery, service bay, main access tunnel Transformer cavern, escape gallery and ,cable tunnel etc.		Tender provisions are clear Kindly refer PTS clause no. 26.1.5
137	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.2.1	Layout and General Arrangement - The Power House building, Control Block ,Transformer cum GIS Cavern shall be divided into following areas for heating, ventilation and air conditioning as indicated in HVAC flow diagram no. NH/DEM/URI-I STG-IIIAC/01.	Drawing mentioned is not available. Kindly provide the same.	Kindly refer revised and substituted vol 4 Tender Drawings as per Corrigendum No.2
138	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.2.2	Cooling Water Circuit - The cooling water for the raw water circuit shall be drawn from the tail race by pumps with automatic self cleaning filters at suction side and cyclone separator and cooling coil of AHU/ packaged AC Units at outlet side. The water after passing through cooling coils shall be discharged to Tail race tunnel. The contractor has to lay a" necessary pipes, valves, instrumentation etc. to make the system complete.	As per clause 26.2.2, once through type AHUs are envisaged i.e. water directly goes from Pump to the Coil of AHUs and then to tunnel race while as per Drawing no. NH/DEM/URI-I STG-IIIAC/01 HVAC Cooling water scheme, chiller system is depicted. Also, In drawing no. NHUR-I(II)-4CT1-41-GA-045 - Power House Longitudnal Section, AHUs are shown in HVAC floor and also there is also EL 1230.10M there are two Chiller Room and AHU Room. Mostly in all Hydro Power Plants including Dibang HEP, once through type AHUs (without chiller) are used. You are requested kindly accept the same.	Kindly adhere to tender specifications
	Volume IV Tender Drawings		NH/DEM/URI-I STG-IIIAC/01	Drawing No. NH/DEM/URI-I STG-IIIAC/01 - HVAC Cooling Water Scheme		
	Volume IV Tender Drawings		NHUR-I(II)-4CT1-41-GA-045	Drawing No. NHUR-I(II)-4CT1-41-GA-045 - Power House Longitudnal Section		
139	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.3.1	The maximum and minimum river water temperatures during the year shall tentatively be considered as 30° C and 3.0°C respectively.	1. Please inform river water to be considered for air sizing calculation. As per specifications, using water at temp 30° C for maintaining temperature of 20-30° C is not feasible. 2. Please note that considering water presence at various floors of power house, precise humidity control may not be achieved at all areas of the powerhouse. Please confirm.	Kindly adhere to tender specifications
	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.3.2	Other areas catered by air handling units in the powerhouse as well as control block floors, transformer cavern, bus duct gallery, escape gallery, cable tunnel etc. shall be maintained at temperatures between 20°C - 30°C at a relative humidity not exceeding 65%.		
140	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.1.2(i)	Required nos. of exhaust air fans for exhaust of air from the battery rooms etc. in power house and DG building with 100% standby capacity.	1. Exhaust fans for DG building are mentioned in multiple clauses with different redundancy. Kindly confirm the location, layout and redundancy of exhaust fans for same. 2. Exhaust fans for GIS area are mentioned in multiple clauses with different redundancy. Kindly confirm the location and redundancy of exhaust fans for same 3. Kindly confirm that there shall be common set of exhaust/Smoke exhaust fans for both caverns i.e. Power House and Transformer cum GIS or Different separate sets of exhaust/Smoke exhaust fans for respective cavern. 4. It is understood that all exhaust air shall be ducted. Kindly confirm the location of all these exhaust/Smoke exhaust fans - i.e. outside or inside portal of which tunnel.	Tender provisions are clear, Kindly adhere to tender specifications
	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.1.2(ii)	Required nos. of exhaust air fans for exhaust of air through exhaust duct from the toilets, kitchen, first aid room, locker rooms, mechanical workshop etc. at different floors in powerhouse and from the toilets etc. in GIS/DG building, each of 100% of required capacity.		
	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.1.2(iii)	Required nos. of exhaust air fans for exhaust of air from the diesel generator room each of 100% of required capacity.		
	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.1.2(iv)	Required nos. of smoke exhaust air fans for exhaust of smoke Air through exhaust duct from all ventilated areas including powerhouse floors, control block, service bay, Transformer cum GIS cavern, galleries, bus duct etc. with 100% stand by capacity.		
	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.1.2(v)	Required nos. of exhaust air fans for GIS room each of 100% of required capacity.		
	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.1.2(vi)	Two (2) nos. of exhaust air fans for 11 KV room at DG room area each of 100% capacity.		

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/Clarifications
	Volume III B (PTS) Chapter 26 HVAC SYSTEM		26.1.2(vi)	Required nos. of exhaust air fans for exhaust of air/smoke from Main Access tunnel, Cable tunnel & Ventilation tunnel with 100% stand by capacity.		
141				General	As percent of Fresh Air is not mentioned, it is envisaged that for ventilation system, only 10% of fresh air shall be provided to maintain sufficient level of oxygen and rest of the air shall be recirculated so that the heating requirements are optimized. Kindly accept.	Kindly refer PTS clause no. 26.5.1 i.e. The system and equipment shall be designed, built, tested and installed to the latest revisions of the applicable standards.
142				General	Kindly confirm - 1. All AC that to be catered by water cooled Package Acs are in Power House cavern. 2. Location of these water cooled Package Acs.	Kindly adhere to tender specifications
143				General	Please confirm if there is any HVAC requirement in Draft Tube Gate Hall.	Kindly adhere to tender specifications
144	Volume V, Attachment 5A		27.1	HVAC SYSTEM INTEGRATOR	From the list of Approved Subcontractors/vendors for HVAC System that has been given in specified clause. Barring one or two vendors, all are either Inactive or not quoting on regular basis. It is requested to kindly accept the participation of all vendors which qualifies above mentioned PQR criterion. Contractor shall undertake proper working of system.	Kindly adhere to tender specifications
145	VOLUME-IV- TENDER DRAWINGS			Power house area general arrangement plan.	Customer to provide lengths of connecting gallery, Adits and tunnels to be illuminated, so that BOQ can be worked out accordingly.	Please refer layout drawings
146	VOLUME-IIB- PARTICULAR TECHNICAL SPECIFICATION PART-II		20.1.4 (g)	All necessary AC copper bus bar (including N bus bar and incomer) of short circuit capability of at least 40 KA for 1 sec	Please note that MLDB shall be provided with Lighting isolation transformer to reduce the fault level to ensure the safety and protection of Lighting fixtures and small power services reducing the fault level to 9 KA for 1 sec and all MCB/MCCBs are designed to cater to 9 KA for 1 sec. Hence the bus bar shall have short circuit current capability of 9 KA for 1 sec	Tender provisions are clear. Kindly adhere to tender specifications
147	VOLUME-IIB- PARTICULAR TECHNICAL SPECIFICATION PART-II		20.1.4 (a)	Required no. of draw out MCCBs Modules	Please note that the incoming of MLDB shall be provided with MCCB and outgoing feeders shall be provided with MCB. All modules are fixed type in MLDB.	Tender provisions are clear
148	VOLUME-IIB- PARTICULAR TECHNICAL SPECIFICATION PART-II		20.1.5 (v)	Coordination and provision of necessary contacts and /or ports for integration with plant control & monitoring system	Please clarify the requirement of provision of contacts/ports and list of signal to be exchanged with plant control & monitoring system. Is the MLDB required to be controlled form Plant control and monitoring system or Energy data is to be transferred from Energy meter to the Plant control & monitoring system	Kindly adhere to tender specifications
149	VOLUME-IIB- PARTICULAR TECHNICAL SPECIFICATION PART-II		20.2.2	The MLDBs and ELDBs shall be fed through station service boards (SSBs) as shown in single line diagram NH/DEM/URI I STG II/LT/01	Please note that the feeding arrangement of MLDBs and ELDBs is not shown in single line diagram NH/DEM/URI I STG II/LT/01	Kindly adhere to tender specifications
150	VOLUME-IIB- PARTICULAR TECHNICAL SPECIFICATION PART-II		20.2.3	In order to achieve the interruption free lighting, entire lighting system (CAN/ACE) of power house control room and critical areas shall be fed through dedicated LDB which shall be fed through Inverter meant for ACE system	Please note that in control room and critical areas generally 30% fixtures are fed from ACE which ensures uniform lux level of 30% of the desired lux level in control room in cas eof normal supply failure i.e. 150 Lux (which is good enough for working for short duration during normal supply failure) out of 500 Lux will be available uniformy in case of normal supply failure for control room and similarly for other critical areas. However, if 100% lighting is provided form ACE, it will increase the loading on ELDB.	Kindly adhere to tender specifications
151	VOLUME-IIB- PARTICULAR TECHNICAL SPECIFICATION PART-II		20.2.3	Control panel shall be designed to enable the lighting levels in different parts of the room to be independently adjusted to take account of : i) Control room operator preference, ii) Nigh-time conditions and daylight conditions.	Please note that the control room needs to be well illuminated at all times for efficient working. Further, the day light can be accessed only if window is available. Please clarify the requirement and usage of Control panel. Is the same required for dimming of lighting fixtures as per operature requirement during night time? However it may lead to difficult in viewing the operator desk and monitoring the plant operations	Tender provisions are clear
152	VOLUME-IIB- PARTICULAR TECHNICAL SPECIFICATION PART-II		20.2.3.2 Power supply	Power and industrial outlet circuits for control room, office areas and individual sockets incorporated in cubicles and cabinets intended for electronic apparatus and computer sockets shall be supplied through inverter.	Please provide the total number and load of such power and industrial outlet circuits so that BOQ and Emergency load of ELDB can be worked out	Kindly adhere to tender specifications
153	VOLUME-IIB- PARTICULAR TECHNICAL SPECIFICATION PART-II		20.5.2	Scheme of Luminaire and fitting	For MIV floor, Runner removal floor, drainage galleries, pump floor, generator barrel (inside) and turbine pit, Access tunnels etc, Water proof LED fittings have been specified in the specification. Please specify the degree of Protection of these water proof LED fixtures to be considered. For construction Adit to Power house cum ventilation tunnel, dust & water proof LED lamp fitting has been specified, please specify the Degree of protection of this LED lamp fitting to be considered.	Kindly adhere to tender specifications
154	Volume-IIIB (PTS) GTR		1.10.2.1	Training during engineering / manufacturing phase	Please provide the following details:- a) The equipment list for which training is envisaged at manufacturer's works like GIS/EHV cables etc. b) The number of man days for each equiments	a) Kindly adhere to tender specifications b)Tender provisions are clear
155	Volume-IIIB (PTS) XLPE Cable		1.10.2.1 i)	Eight (8) nos. Single-phase, 400kV copper conductor, Fibre Optic embedded XLPE cables of minimum 2000 mm2 for interconnection with two outgoing bays of GIS of Uri I Stage II Project, (i.e one with outgoing bay of Uri I Stage I GIS and other with existing line bay at pothead yard of Uri I Stage I)	Please provide the power flow in the two outgoing bays of Uri I Stage II Project for estimating 400kV XLPE cable sizing or please confirm the rated continuous current to be considered as 1800 Amps for cable sizing.	Tender provisions are clear
	Volume-IIIC (TDS) XLPE Cable		10.1	2.8. Rated Continuous Current- 1800 Amps		Tender provisions are clear

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/Clarifications
156	Volume-IIIB (PTS) XLPE Cable		1.10.2.1 i)	Eight (8) nos. Single-phase, 400kV copper conductor, Fibre Optic embedded XLPE cables of minimum 2000 mm2 for interconnection with two outgoing bays of GIS of Uri I Stage II Project, (i.e one with outgoing bay of Uri I Stage I GIS and other with existing line bay at pothead yard of Uri I Stage I)	A) Bidder understand 400kV XLPE cable will be laid in the cable cum ventilation tunnel as mentioned in the reference drawings. Please confirm. B) Only part Section plan for the Cable cum ventilation tunnel is shown in the drg ref NHUR-I(II)-4CT1-41-GA-064, please provide the complete section plan of connection between the Stage-1 GIS Cavern and Stage-II GIS Cavern. C) The mentioned drawings are not legible, please provide a legible copy. D)The cable tunnel connecting to GIS cavern of Stage-II to existing pothead yard is not appearing. Please provide the drawing for the same. The above details/confirmation is required for estimation of the 400kV XLPE cable circuit lengths.	Tender provisions are clear
	Volume-IV Drawings			A) Power House Area Caverns General Arrangement Plan (Drg no. NHUR-I(II)-4CT1-41-GA-043) B) Power House Cable Cum ventilation Tunnel Plan (Drg no. NHUR-I(II)-4CT1-41-GA-063) C) Power House Cable cum ventilation Tunnel Section (Drg no. NHUR-I(II)-4CT1-41-GA-064)		Refer PDF dwg
157	Volume-IIIB (PTS) GIS		11.1.1	b) Three (3) Single Phase, 7-Core, multi ratio, Current Transformer	Due to OEM manufacturing limitaions,7 cores may not be accomodated in single CT modules and 02 number CT modules may be required. Please confirm same will be acceptable.	Agreed,however,Tender provisions are clear in this regard.
158	Volume-IIIB (PTS) GIS		11.1.1.4 f)	f) Three (3) SF6 / XLPE bushings for feeder connections*, * The scope of work for outgoing feeder terminations at GIS end of Uri Power station and at Pothead yard are stipulated in "Section 10 - 400 kV XLPE cables of Technical Specification (PTS)".The contractor shall co-ordinate the interface and scope of supply between manufacturer of GIS.GSU transformer & XLPE. The scope shall be as per relevant IEC	Since the scope includes outgoing feeder terminations at GIS end of Uri Power station Stage-I. Please provide the following information:- a) Spare Line bay feeder with XLPE cable termination module is already existing in Uri-Stage-I GIS. Please confirm. b) Please provide the make of GIS at Uri-1 Stage-I. c) Bidder scope at Uri-1 Stage-1 GIS area is limited to termination of the 400kV xlpe cables only. Further testing and commissioning of the Line bay feeder(including gas filling) is not envisaged in the current scope. Please confirm. d) Bidder understand arranging GIS OEM at Uri-1 Stage -1 GIS during termination of 400kV XLPE cable is not under bidder scope. Please confirm. e)Bidder scope at Uri-1 Stage-1 Pothead Yard area is limited to termination of the 400kV xlpe cables at the cable sealing end only. Further connection from CSE to Pothead Yard feeder bay is not envisaged in the current scope. Please confirm.	Make of GIS at Uri I is M/s ABB. Tender provisions are clear. Kindly adhere to tender specifications.
159	Volume-IIIB (PTS) GIS		11.1.1.9	9) Cable tray, Cable pit / trench for connecting cable between LCC to main equipment and from LCC to LCa shall have state-of-art covering/chequered plates as finalized during detail engineering and shall be in GIS manufacturer's scope.	Bidder understand since the scope of work is under Electro-mechanical page so contruction of cable pit/trench shall be excluded from the current scope of E&M Contractor. Please confirm.	Tender provisions are clear
	Volume-IIIA (GTS)		8.8.vi)	8.8 Civil Site Work vi) Provision of cable and pipe ducts, trenches, block-outs, drilling for grounding system etc., in accordance with the drawings supplied by the Contractor and supervised by the Contractor.		Tender provisions are clear
160	Volume-IIIB (PTS) GIS		11.2.1	Due to high altitude, clearances and ratings of equipment would be kept suitable for installations at an altitude of EL. 1251.8 m, with ice/snow considerations. The GIS and transformers are housed in a separate cavern, GIS hall is located above to transformer hall at EL 1251.8	Bidder understand since the GIS wil be installed in indoor location, Ice/Snow is not applicable. Please confirm.	Tender provisions are clear
161	Volume-IIIB (PTS) GIS		11.2.2.iii)	iii) The interconnection between main GSU transformers and respective unit bays of GIS shall be through 420 kV GIB. Transformers are placed at EL 1251.8M in transformer cavern. The interconnection between bus reactor located in transformer cavern and respective reactor bay of GIS shall be through 420 kV GIB.	Bidder understand Transformer and Bus Reactor are placed at EL 1239.8. Please confirm	Tender provisions are clear
	Drawing- Transformer cavern Plan & Section			Plan at Level EL 1239.8		Kindly Refer the layout drawings.
162	Volume-IIIB (PTS) GIS		11.5.2.d)	d) All the partition/ compartment shall be designed for one side at rated pressureand other side at vacuum so as to perform maintenance safely. The contractor shall demonstrate through gas compartment segregation or otherwise how compliance of service continuity as per S. No. b, c, f and g are achieved.	A) Employer is requested to exclude/delete the below mentioned clause as OEMs will not be able to comply. "All the partition/ compartment shall be designed for one side at rated pressureand other side at vacuum so as to perform maintenance safely". However, Bidder confirms compliance of service continuity as per S. No. b, c, f and g. Please confirm.	Kindly adhere to tender specifications

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163	Volume-IIIB (PTS) GIS		11.5.2.f)	f) Future extension of bays, with maximum one bus outage at a time. The arrangement of gas sections or compartments shall be such as to facilitate future extension on either end.	Please provide the following information:- a) Number of future bays envisaged. B) Provision to provide auxiliary power to future GIS bays is not envisaged in the current scope. Please confirm. c) Bidder understand provision for GIS extension is envisaged at one end only. Please confirm. d) Bidder understand placement of each GIS bays just above the corresponding GSU transformers and Bus Reactor is not envisaged. Please confirm.	a)01 no. future bay has been envisaged. B) Tender provisions are clear c)Tender provisions are clear d) Kindly adhere to tender specifications
164	Volume-IIIB (PTS) GIS		11.5.7	Scope shall cover any additional CTs and/or no. of cores for CTs for additional protection and metering if felt necessary during detailed engineering.	a)The number of CTs will be as per the single line diagram for 420 kV GIS given in drawing no. NH/DEMI URI I STG II/SLD/02 . Please confirm b) In case of additional requirements please provide the details of the same for consideration in the bid estimates.	Tender provisions are clear. Kindly adhere to tender specifications
165	Volume-IIIB (PTS) GIS		11.5.8	Scope shall cover any additional VTs and/or no. of cores for VTs for additional protection and metering if felt necessary during detailed engineering.	a)The number of VTs will be as per the single line diagram for 420 kV GIS given in drawing no. NH/DEMI URI I STGII/SLD/02 . Please confirm b) In case of additional requirements please provide the details of the same for consideration in the bid estimates.	Tender provisions are clear. Kindly adhere to tender specifications
166	Volume-IIIB (PTS) GIS		11.5.12	Number/position of surge arrestor as shown in Tender drawing is indicative and will be finalized during detail engineering based on insulation coordination studies.	a)The number of Surge arrestors will be as per the single line diagram for 420 kV GIS given in drawing no. NH/DEMI URI I STGII/SLD/02 . Please confirm b) In case of additional requirements please provide the details of the same for consideration in the bid estimates.	Tender provisions are clear. Kindly adhere to tender specifications
167	Volume-IIIB (PTS) GIS		11.5.19	Implemented technology for control shall be digital and local control cubicle shall incorporate bay control unit for integration to plant SCADA system through local control Board for GIS. Colour of the cubicles shall be as per GTR clause no. 1.5.2- Colour schedule.	Local Control Cubicle (LCC) are in the scope of GIS OEMs, whereas Bay control unit are part of Control & monitoring system. It is requested to accept mounting of Bay control units in separate panels which will be kept in vicinity of LCCs.	Tender provisions are clear
168	Volume-IIIB (PTS) GIS		13.2.1	A tentative arrangement is proposed in the single line diagram no. NH/DEM/ URI I STG-II /DC/01and NH/DEM/ URI I STG -II/DC/02 of 220V and 48V DC system respectively.	single line diagram no. NH/DEM/ URI I STG -II/DC/02 of 48V DC system is not available. Please provide the same.	Refer amended pdf drawing
169	Volume-IIIB (PTS) LV Switchgear		19.2.1	The flood dewatering pump shall normally be fed from Flood dewatering cum disaster management board at GIS hall with provision of charging from GIS distribution board and from LV side GIS Auxiliary Transformer. The GIS distribution board shall be fed from SSB-1 & SSB-2. Necessary interlock for avoiding mixing of supply must be ensured.	A)Bidder understand the GIS auxiliary transformer is not catering to GIS auxiliary power requirements. The Purpose of the auxiliary transformer is to supply power from 11kV Board at Potyard to Flood dewatering cum disaster management board. Please confirm. B) The Location of the Flood dewatering cum disaster management board and Auxiliary Transformer for Disaster management & Flood Dewatering is not shown in the GIS Floor drawing. Bidder understand there will be separate swithgear room for placing the same. Please mark the location in the drawing.	a)Yes b)Tender provisions are clear,however,specific details shall be dealt during detail engineering.
	Volume-IIIB (PTS) LV Switchgear		19.1.1	One(1) nos., 11 /0.415 KV, 800 KVA dry type, 3-phase - Auxiliary Transformer for Disaster management & Flood Dewatering (to be placed at GIS floor)		Tender provisions are clear
	Volume-IV Drawings			Drg No. NHUR-1(II)-4GT1-41-GA-054 Transformer Cavern Plan at EL 1251.80M(GIS FLOOR)		
170	Volume-IIIB (PTS) LV Switchgear		19.1.2	iv) One (1 set) of distribution Board for Pot yard viii) One (1) set of Distribution board for flood dewatering & disaster management (to be placed at GIS hall).	A) The SLD of the board is not available, please provide the incoming /outgoing feeder details B) The location of the boards is not marked in any drawing. Please mark the same.	Shall be dealt during detailed engineering
171	Volume-IIIB (PTS) Illumination		20.2.1	B)Outdoor lighting The lighting Network of Outdoor Pothead yard.	A)Bidder understand that Pothead Yard is completely excluded in the current scope. There is no drawings/Specification of Pothead yard area. Hence It is requested to please exclude illumination scope of Pothead Yard area as well. Please confirm. B) If otherwise , then drawings of the pothead yard area marking the EHV equipments/DG room and other facilities to be provided.	Tender provisions are clear. Kindly adhere to tender specifications
	Volume-IIIC (TDS) Pothead Yard		12	Not applicable		
172	Volume-IIIB (PTS) Illumination		20.2.1	However, area supplied from MLDBs of Power house and Pothead yard shall be finalised during detail engineering.	Please provide the details of the illumination scope to be covered by Pothead Yard MLDB. Same is required for sizing calculation.	Tender provisions are clear
173	Volume-IIIA (GTS)		1.3	If requested by the Engineer in-Charge the Contractor shall supply at his own expense three copies in English and one in the original language of any national standards, which are applicable to the Contract.	Bidder understand the copy of applicable national standards i.e BIS standards only are to be provided. Please confirm.	Tender provisions are clear
174	Volume-IIIA (GTS)		4.10.4	Painting in respect of standard items shall be acceptable as per manufacturer practice	Bidder understand for GIS, OEM painting practice is acceptable. Please confirm.	Tender provisions are clear

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175	Volume-IIIA (GTS) Annex-2			REQUIRED DOCUMENTS FOR E&M EQUIPMENT 14 i) Insulation coordination studies	Bidder understand the pothead yard area equipments are not in current scope. However sizing of the Line side Surge arrestors will be recommended by bidder. Please confirm.	Tender provisions are clear
176	Volume-V Appendix 2. Price Adjustment		22	1.Price Adjustment Formula for Supply of Plant and Equipment	For the 400kV XLPE cable(Item no. 10.1 of Price Schedule 1), employer is requested to accept Price adjustment for supply as per the applicable IEEMA standard.	Tender provisions are clear. Please adhere to bid specifications.
177				General	We understand that creepage is 25mm/KV. Please confirm.	Tender provisions are clear
178	Volume-IIIC (TDS) Pothead Yard		12	Not applicable	We understand that following works are excluded from current scope at the Pothead Yard Area. Please confirm. A) Supply and Erection of Pothead Yard Equipments. B)Cabling Works(both LT Power and Control) including cable trays/racks C) Auxiliary Power arrangement for Potheadyard Equipments. D) Fencing works E)Lightning Protection etc.	Tender provisions are clear
179	Volume-V Attachment 5B		1.1.8	TURBINE DISCHARGE MEASURING EQUIPMENT	Employer is requested to revise the clause II) as "The equipment so manufactured should have been in successful operation at least in any one hydro Power station / any other industry"	Kindly adhere to tender specifications
			2.2	PRESSURE ACCUMULATOR TANK		
			2.4	SERVO/PROPORTIONAL VALVES		
			3.4	PRESSURE ACCUMULATOR TANK		
			3.5	OIL PUMPS		
			4.2.7 to 4.2.13	MERCURY/ GAS IN STEEL THERMOMETERS (DTT) PRESSURE SWITCH FLOW RELAY AND FLOW METER PRESSURE TRANSMITTERS THERMOSTATS RTD MOISTURE DETECTOR	
			27.3	AIR DRYER		
			29.1	OIL FILTRATION PLANT		
			29.2	PUMPS		
			33.0	MISCELLANEOUS ITEM		
180	Volume-V Attachment 5B		13.2	BATTERY CHARGERS	400 KV class is not relevant to battery/ battery charger. Employer is requested to change the requirement as " power stations/ sub stations/ any other industrial application"	Please refer Corrigendum No. 2
181	Volume-V Attachment 5B		16	CABLING SYSTEM	Clause - i) Experience requirement of 1000 km quantity is too high, Employer is requested to kindly change this requirement to 100 km. Also, LT/ 11KV and control cable are not relevant for switchyard KV rating (220 KV).Employer is requested to kindly remove this requirement. Clause ii) Performance certificate is difficult to obtain for the vendors as they deal with the contractors and not the end customers. Employer is requested to accept Inspection reports/ invoices/ delivery challans/ lorry receipts as proof of supply/ quality. Kindly confirm.	Kindly adhere to tender specifications
182	Volume-V Attachment 5B		16.1	11 KV XLPE CABLES	Clause - i) Experience requirement of 100 km quantity is too high, Employer is requested to kindly change this requirement to 25 km. Clause ii) Performance certificate is difficult to obtain for the vendors as they deal with the contractors and not the end customers. Employer is requested to accept Inspection reports/ invoices/ delivery challans/ lorry receipts as proof of supply/ quality. Kindly confirm.	Kindly adhere to tender specifications
183	Volume-V Attachment 5B		16.2	LT POWER CABLES	Clause - i) Experience requirement of 500 km quantity is too high, Employer is requested to kindly change this requirement to 100 km. Clause ii) Performance certificate is difficult to obtain for the vendors as they deal with the contractors and not the end customers. Employer is requested to accept Inspection reports/ invoices/ delivery challans/ lorry receipts as proof of supply/ quality. Kindly confirm.	Kindly adhere to tender specifications
184	Volume-V Attachment 5B		16.3	CONTROL CABLES AND INSTRUMENTATION CABLES	Clause - i) Experience requirement of 500 km quantity is too high, Employer is requested to kindly change this requirement to 100 km. Clause ii) Performance certificate is difficult to obtain for the vendors as they deal with the contractors and not the end customers. Employer is requested to accept Inspection reports/ invoices/ delivery challans/ lorry receipts as proof of supply/ quality. Kindly confirm.	Kindly adhere to tender specifications

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185	Volume-V Attachment 5B		16.4	CABLE TRAYS, RACKS INCLUDING ACCESSORIES	Clause - i) Experience requirement of 100 km quantity is too high, Employer is requested to kindly change this requirement to 25 km. Also, Employer is requested to change part of clause as" ...at minimum three Power stations/ sub station/ any other industrial application". Clause ii) Performance certificate is difficult to obtain for the vendors as they deal with the contractors and not the end customers. Employer is requested to accept Inspection reports/ invoices/ delivery challans/ lorry receipts as proof of supply/ quality. Kindly confirm.	Kindly adhere to tender specifications
186	Volume-V Attachment 5B		19.1	415V SWITCHGEAR PANEL/ UAB/ SSB19.1	Employer is requested to include DCDB also. "415V SWITCHGEAR PANEL/ UAB/ SSB / DCDB" as Panel manufacturer of LTAC and DCDB shall be same as both are distribution boards. Kindly accept and confirm.	Tender provisions are clear
187	Volume-V Attachment 5B		21	COMMUNICATION SYSTEM	Clause i) Experience for other sectors apart from hydro power stations may also be considered like thermal Power stations/ other power stations/ any other industrial applications, offices, etc. Clause ii) Capacity of 25 MW is not relevant for Communication system. Employer is requested to remove this requirement. Performance/ satisfactory operation of 2 years is not relevant for communication system. Employer is requested to remove this requirement. Employer is requested to consider Commissioning report/ installation report. Kindly confirm.	Kindly adhere to tender specifications
188	Volume-V Attachment 5B		22	ELECTRICAL WORKSHOP	Clause ii) Requirement of satisfactory operation of 2 years at 2 Power stations is not relevant. Employer is requested to consider Proof of supply in place of performance certificate from power stations/ Sub Station/ industrial applications/ labs/ institutions. Kindly confirm. As these items are not supplied by OEMs themselves. Therefore, Employer is requested to kindly remove requirement of submission of detailed documents like company profile, technical & manufacturing capability, financial resources etc.	Kindly adhere to tender specifications
189	Volume-V Attachment 5B		32.1	SECURITY AND SURVIELANCE SYSTEM INTEGRATOR	Employer is requested to consider experience for power stations, industrial applications, offices, etc. Employer is requested to reduce no of experiences from Three (3) to Two (2) Performance/ satisfactory operation of 2 years is not relevant for security & surveillance system. Employer is requested to consider Installation report/ commissioning report	Kindly adhere to tender specifications
190	Volume-V Attachment 5B		32.2	ACCESS CONTROL SYSTEM AND CCTV SURVELLIANCE SYSTEM	Employer is requested to consider experience for power stations, industrial applications, offices, etc. Performance/ satisfactory operation of 2 years is not relevant for security & surveillance system. Employer is requested to consider Installation report/ commissioning report	Kindly adhere to tender specifications
191	Volume-V Attachment 5B			General - Attachment 5B	Employer is requested to allow Prequalification criteria (PQR) to be supported by delivery challan/invoice copy. Performance certificates are generally not issued by customer to vendors, so this requirement of this document may be waived off.	Kindly adhere to tender specifications
192	Volume-V Attachment 5B		1.0	TURBINE AND ACCESSORIES	Employer is requested to reframe this clause for all items as below including the Lift Irrigation Scheme projects. " ii) The equipment manufactured for similar item should have been in satisfactory operation for at least two years at minimum one (1) Hydro Power Station / Pump Storage Plant / Lift Irrigation Scheme Pump Station." Employer is requested to delete Sub-para for LIS scheme.	Kindly adhere to tender specifications
193	Volume-V Attachment 5B		1.1.2	TURBINE SHAFT	Employer is requested to revise Sl. no. i) of "NOTE" for Turbine shaft as " i) Turbine Shaft: Outer dia. (body) x Length "	Kindly adhere to tender specifications
194	Volume 5 (Forms & Procedures) Attachment 5 B		26.1	26.1 HVAC SYSTEM INTEGRATOR The Sub-contractor/vendor/Integrator: i) Should have designed, supplied and commissioned HVAC system for underground power station having capacity of 25MW or above earlier during the last fifteen(15)years ending last day of the month previous to the one in which Contractor proposes / applies for inclusion. ii) The system so supplied should have been in satisfactory operation for at least two years at minimum two hydro power stations. iii) Should be an ISO certified company. In support of above, documentary evidence duly certified by contractor along with the complete details of the company profile be furnished. Further, certification by contractor shall also be submitted that the vendor is having sufficient technical capability and financial resources to design, supply & commission the item(s)/component(s) required for the project	Specific Qualification criteria mentioned in the tender specification is very restrictive in nature due to following reasons: 1. It is very difficult to find suppliers in the industry who have underground HVAC experience. HVAC being a generic field used in hospitals, Airports, Malls, Residential Building & other commercial establishments. Accordingly, experience of HVAC supplier in any industry (including thermal Power) experience may also be accepted. We propose Following Standard PQR i) Bidder should have designed, supplied, erected and commissioned at least one (1) no. Air Conditioning or Ventilation system in industrial / commercial installations, consisting of Single Unitary air filtration/ Air Washer / Fan Filtration / Air Handling Unit, with Centrifugal Fan / Axial Fan, of total capacity 50,000 Cu. Mtr. / Hr. at least, along with associated ducting work etc., which are in successful operation for a period of not less than one (1) year as on date of bid-opening (of enquiry floated by main contractor for HVAC system). ii) Should be an ISO certified company. Kindly accept.	Kindly adhere to tender specifications
195	Volume-V Attachment 5A		List of Approved Vendors	List of Approved Vendors	Proposed list for additional venders is enclosed as Annexure-A. Employer is requested to kindly accept and confirm.	Kindly adhere to tender specifications
196			1.1.8	RUNNER	ADDITIONAL VENDORS TO BE ADDED STAR WIRE SAURABH METALS	Kindly adhere to tender specifications

Sl. No.	Volume	Page No.	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/Clarifications
197	Vol IIIB	1-20, 21	1.11.3	Creation of warehouse facilities	Building size is given as 80m x 28 m approx, however crane span required is indicated as 18m. Employer is requested to clarify the same. Also please specify "adequate span " requirement in GIS store. Also, Employer is requested to furnish relevant drawings of stores.	Bid Provisions are clear Crane span is only 18 m not in full width of building
198	Vol IIIB	1-20, 21	1.11.3	Creation of warehouse facilities	1. Employer is requested to furnish Soil Report & Contour Drawing which are required for designing civil Foundation of Stores. 2. Employer is requested to furnish the Wind Zone & Seismic Zone of the area where stores are to be constructed. 3. Employer is requested to provide the location of Stores with respect to the plant roads. Employer is also requested to provide approach road width and length to the E&M and GIS Store. 4. Bidder understands that the flooring of building shall be heavy duty RCC flooring. Please confirm. 5. Bidder understands that the walkway with chequered platform shall be provided in the stores building on both sides of the hall/ both ends of the crane. Please confirm. 6. Bidder understands that the only one cage ladder shall be provided for walkway of each side to access the crane in the stores building. Please confirm. 7. Bidder understands that each store building shall have 02 nos rolling shutters with maximum size of 4.0m (width) x 5.0m (height). All rolling shutters will be mechanically operated. Please confirm. 8. Bidder understands that all the windows and rolling shutter in the Stores building shall be of MS painted with Red Oxide Primer & Paint. Please confirm. 9. Bidder understands that the land is suitable for open foundations and Stores building shall have open foundations only. Please confirm. 10. Bidder understands that the levelled and graded land shall be provided to the bidder for construction of the both stores. Please confirm. 11. Bidder understands that the mean probable design life of stores will be 25 years i.e. as per a permanent building. Please confirm. 12. Employer to Please inform if the store will be fully covered or partially covered.	The store shall be in the vicinity of Power house , however the details shall be finalized during detail engineering
199	Vol IIIB	1-20, 21	1.11.3	Power arrangement, wiring/electrification along with lighting inside/ outside of warehouse shall be in the scope of E&M Contractor,	1. Bidder understand Air conditioning/ ventilation system is not envisaged for the Stores. Please confirm. 2. Bidder understand Fire Protection system is not envisaged for the Stores. Please confirm. In case of requirement, please provide the details. 3. Bidder understands wall mounted fans are not envisaged. Please confirm. 4.Please provide the location of the nearest board from which power will be considered for the stores' illumination and EOT cranes. In case power is to be given from GIS distribution board, please provide the tentative distance of the stores from GIS cavern /Power House or mark the location in the layout drawing.	The details shall be finalized during detail engineering
200	Vol IIIB	2-5	2.2.4	Construction Methodology	Bidder understand that the 20T Temporary EOT Crane is in the scope of Civil contractor, and is not part of this E&M tender. Please confirm.	Bid Provisions are clear

INFORMATIVE REPLIES

PART-D

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
1	VOLUME – III B: PARTICULAR TECHNICAL SPECIFICATIONS (PTS) 2 TURBINE AND ACCESSORIES	2.2.2	2.2.2 Hydraulic Conditions	2-3	iii Maximum tail water level (with all unit operation at full load) : EL 1241.00 M iv Minimum tail water level (with one unit running at no load) : EL 1241.00 M	During the load variation, it is expected to vary the tail water level due to change in the discharge/ water column height at TRT exit. Hence, we kindly request you to review the specified tail water level and reconfirm the TWL corresponding to- 1. TWL corresponding to all unit in operation at full load 2. TWL corresponding to one unit in operation at full load 3. TWL corresponding to one unit running at no load	Bid provisions are clear
2	VOLUME – III B: PARTICULAR TECHNICAL SPECIFICATIONS (PTS) 2 TURBINE AND ACCESSORIES	2.2.2	2.2.2 Hydraulic Conditions	2-4	ix. Operating range of net heads: a. Rated Net Head : 227 m b. Maximum Net Head : 227 m c. Minimum Net Head : 227 m	We understand that the rated net head (227 m) is defined based on the FRL EL 1491m & TWL EL 1241.0m and 23m head loss corresponding to both unit running at rated condition. However, while 1 unit in operation, the head loss thru the water conductor system shall be less and effective net head at unit will increase. So maximum net head and rated net head can not be same. In view of the same, kindly review the specified net head and confirm the head as mentioned below: 1) Rated net head (while both unit in operation at full load & at FRL condition) 2) Maximum net head (while one unit in operation at full load & at FRL condition) 3) Minimum net head (while both unit in operation at full load and operating at MDDL (if any))	Bid provisions are clear
3	VOLUME – III B: PARTICULAR TECHNICAL SPECIFICATIONS (PTS) 2 TURBINE AND ACCESSORIES	2.3.3.	2.3.3 Pressure Rise and Speed Rise	2-6	The maximum pressure rise at turbine inlet, considering the effect of water hammer under worst conditions of load acceptance/ rejection and governor closing/ opening times shall be indicated by the customer. However, the pressure rise shall not be more than 23% of static head at 262.3 head and speed rise shall not be more than 43% of the synchronous speed i.e 333.33 rpm under any worst condition.	The specified pressure rise limit of 23% of maximum static head is on very conservative side. Also, it is not matching with the pressure rating (36 bar) specified for design of turbine and Main inlet valve. Hence, we propose to keep the pressure rise limit as 35% of maximum static head inline to IS12837. Kindly confirm.	Please refer Corrigendum No 2
4	VOLUME – III B: PARTICULAR TECHNICAL SPECIFICATIONS (PTS) 2 TURBINE AND ACCESSORIES	2.5.4	2.5.4 Fixed/ embedded components	2-14	2.5.4.1 Spiral Case The spiral case shall be designed for minimum internal design pressure of 36 bars.....		
5	VOLUME – III B: PARTICULAR TECHNICAL SPECIFICATIONS (PTS) 4 MAIN INLET VALVE AND ACCESSORIES	4.2.3	4.2.3 Design Consideration	4-3	4.2.3.1 Special Design Consideration i) Valve in open or close position withstanding the total maximum water pressure of 36 bars, which includes the pressure rise and allowance		
6	VOLUME – III C: TECHNICAL DATA SHEETS (TDS) 2 TURBINE AND ACCESSORIES	2.1	2.1 Guaranteed Technical Particulars Item 2	-	2 Maximum water hammer over pressure at static head of 262.3 m at full gate output rejection of any of the units and under any worst condition: Not more than 23%		
7	VOLUME – III B: PARTICULAR TECHNICAL SPECIFICATIONS (PTS) 2 TURBINE AND ACCESSORIES	2.3.3.	2.3.3 Pressure Rise and Speed Rise	2-6	The maximum pressure rise at turbine inlet, considering the effect of water hammer under worst conditions of load acceptance/ rejection and governor closing/ opening times shall be indicated by the customer. However, the pressure rise shall not be more than 23% of static head at 262.3 head and speed rise shall not be more than 43% of the synchronous speed i.e 333.33 rpm under any worst condition.	The specified speed rise limit are different in mentioned clauses 2.3.3 & 5.3.7. We understand that the speed rise shall not be more than the 55% of the rated speed under any condition of operation considering the worst condition of load acceptance/ rejection. Kindly confirm.	Bid provisions are clear
8	VOLUME – III B: PARTICULAR TECHNICAL SPECIFICATIONS (PTS) 5 GENERATOR	5.3.7	5.3.7 Maximum momentary over speed	5-4	The flywheel effect of the generating unit and governor closing and opening times shall be so adjusted that the speed rise shall not exceed 55% (Fifty five percentage) of the rated speed under any condition of operation considering the worst condition of load acceptance/ rejection and shall be indicated by the contractor.		

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
9	VOLUME – III C: TECHNICAL DATA SHEETS (TDS) 2 TURBINE AND ACCESSORIES	2.1	2.1 Guaranteed Technical Particulars Item 1.1.5	-	1.1.5 Maximum speed rise at synchronous speed i.e 333.33 rpm caused by load rejection from full gate output to zero and under any worst condition : Not more than 43%		Please refer Corrigendum No 2
10	VOLUME – III B: PARTICULAR TECHNICAL SPECIFICATIONS (PTS) 2 TURBINE AND ACCESSORIES	2.4.3	2.4.3 Cavitation pitting guarantee	2-7	If any of the runner passages or any individual turbine component separately listed above fails to meet the above guarantee, the contractor shall at his own expense, repair the pitting area by welding and also repair in a satisfactory manner all other areas..... .....Subsequent to repair, the repaired runner and turbine components will be subject to the above pitting guarantee for another period of 8000 operation hours of power production. The guarantee will be renewed each time the turbine fails to meet the guarantee.....	We understand that the cavitation guarantee shall be renewed if the turbine fails to meet the guarantee but the maximum warranty period shall be limited/ capped inline to the "clause 27 Defect Liability of Vol II A - GCC". Kindly confirm.	Bid provisions are clear
11	VOLUME – III B: PARTICULAR TECHNICAL SPECIFICATIONS (PTS) 2 TURBINE AND ACCESSORIES	2.4.6.5	2.4.6.5 Model Acceptance	2-11	3) Should the model fails to meet the requirement of guarantee and other requirements, the contractor shall modify the same until it complies with the requirements. All expenses involved for the modification and subsequent model tests shall be borne by the contractor.	As per the tender specification, revolving model test guarantee is required. We kindly request you to modify the model acceptance clause as below to define the capping in case of any shortfall. "3.Should the model fails to meet the requirement of guarantees and other requirements, the penalty shall be imposed as per LD defined in "clause 2.4.4 of Vol III B-PTS" upto shortfall in WAE of 0.5% after applicable IEC tolerance Below the 0.5% shortfall, it shall be optional for the Engineer-of-Contract to conditionally accept the model and direct the Contractor to modify the model. All expenses involved for the modifications and subsequent model tests shall be borne by the Contractor. If the contractor is able to achieve maximum guaranteed efficiency or more as mentioned in the Bid during field acceptance test, penalty imposed on account of shortfall in efficiency during model test shall be waived off."	Bid provisions are clear
12	VOLUME – IV: Tender Drawings		Power House DRAINAGE GALLERY & DRAFT TUBE PLAN AND SECTION			We understand that the draft tube dimensions (depth, length, exit height, exit width) specified in tender drawings are tentative and bidder can select the draft tube dimensions as per selected hydraulic solution. Kindly confirm.	Kindly adhere to technical specifications.
13	VOLUME – IV: Tender Drawings		GENERAL			The waterways and PH layout drawing shared in the Vol IV - Tender drawings are not clear to consider the data for transient analysis point of view. We kindly request to share the drawings listed as below in AutoCAD format for further consideration. 1. Waterways L section (from Intake to TRT Exit) 2. Waterways cross section of each type of tunnel/ penstock 3. Upstream surge shaft cross section/ plan and flow coefficient 4. Downstream surge gallery cross section/ L section/ plan and flow coefficient 5. PH layout - Cross section, Longitudinal section and Plan	Please refer Corrigendum No 2
14	Vol-III B (Particular Technical Specifications (PTS)), GENERAL TECHNICAL REQUIREMENTS	1.5.1.1	Maximum allowable stresses	1-5	ii) Direct or combined steady stresses For materials used in the construction of the equipment, unless otherwise specified, the maximum stress due to maximum normal rated load operating conditions shall not exceed one-third of the minimum yield point or one-fifth of the minimum ultimate strength of the material, which ever is lower. Maximum unit stresses in rotating parts of the turbine due to maximum runaway speed or in parts under hydrostatic test conditions shall not exceed two-thirds of the minimum yield point.	The design stress limit shall be followed as for the conditions occurring in normal operation shall not exceed one-half (1/2) of the yield strength of the material and for the most severe operating conditions like pressure test and runaway speed etc. the stresses shall not exceed three-fourth (3/4) of the yield strength. For other materials used in the construction of the turbine and associated equipment, the maximum stresses in tension or compression due to the most severe conditions occurring in normal operation shall exceed one-half (1/2) of the yield strength of the material. Please review the requirement and confirm the above mentioned stress criteria as followed for the hydro turbines world wide based on the advanced tool/ software's calculations.	Bid provisions are clear
15	Vol-III B (Particular Technical Specifications (PTS), GENERAL TECHNICAL REQUIREMENTS	1.5.1.3	Silt erosion consideration	1-6	The project is situated in Himalayan region where the silt content during high flow period is excessive and peaks abnormally during high flood. Sediments of Himalayan Rivers may contain high quartz content. The underwater components are expected to operate under silt concentration up to 3000 ppm.	It is not recommended that the underwater turbine components shall be operated under silt concentration up to 3000 ppm. This limit shall be mutually discussed and agreed during the detail Engineering. Please review the requirement.	Bid provisions are clear

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
16	Vol-III B (Particular Technical Specifications (PTS), GENERAL TECHNICAL REQUIREMENTS	1.5.1.6	Transportation limitations	1-7	For shipments, the Manufacturer shall pack the items to meet size and weight restrictions of the Indian railways and road systems.	Please provide the transport limit as Length*Width*Height and weight limit.'	Please refer Corrigendum No 2
17	Vol-III B (Particular Technical Specifications (PTS), GENERAL TECHNICAL REQUIREMENTS	1.9.1	Special tools	1-17	The tools and plants like mobile crane, trailer, truck, hydraulic jacks,welding generators, hydraulic test pumps, drill machines, torque wrenches, chain pulley blocks, dewatering pumps, HV testing kit, Drying out transformer, brazing equipment etc., shall be arranged by the contractor.	The tools and plants like mobile crane, trailer, truck, hydraulic jacks,welding generators, dewatering pumps, HV testing kit, Drying out transformer, brazing equipment etc., shall be arranged by the civil contractor. Please confirm.	Bid provisions are clear
18	Vol-III B (Particular Technical Specifications (PTS), GENERAL TECHNICAL REQUIREMENTS	1.11.4	Special software	1-21	(ii) Simulation and design Software tool for designing of Hydro Power units / turbines having following capabilities:- * Modelling, Simulation and analysis of the power networks dynamic behavior, speed drives and hydraulic systems with arbitrary topology. * Design and Analysis of water Conductor system * Water Hammer Calculation/Rotating inertias,/ Hydraulic Transient Studies including speed rise, pressure rise, guide vane opening/ closing time in seconds * Electrical Transient Studies including transients in 4-quadrant operation * Designing/ Dimensioning / Sizing of turbine-generators bearing arrangement, suction head, unit spacing, rated rpm, etc. The software should have the ability to include all the above components into simulation. (iii) 2D and 3D Computer aided design software for preparation and review of drawings for approval.	(i) Being proprietary softwares these softwares cannot be shared. (ii) 2D and 3D computer aided design software for preparation and review of drawings for approval can be provided. However, we request you to please inform the number of licence required for 2D and 3D softwares.	Bid provisions are clear
19	Vol-III B (Particular Technical Specifications (PTS), TURBINE AND ACCESSORIES	2.5.3	Material selection and standards	2-13	3. Rotating labyrinth (Upper & Lower) — Forged Stainless Steel, 13Cr-4Ni — ASTM A473 UNS S41500 4. Fixed labyrinth (Upper & Lower)	Material ASTM A 743 CA6NM shall also be acceptable for the Fixed and Rotating labyrinths in addition to the material specified in the tender specification as per bidder standard practice.	Bid provisions are clear
20	Vol-III B (Particular Technical Specifications (PTS), TURBINE AND ACCESSORIES	2.5.3	Material selection and standards	2-14	9. Bottom Ring — Carbon Steel, — ASTM A 516 Grade 70 10. Head cover — Carbon Steel, — ASTM A 516 Grade 70 11. Draft tube cone — Carbon Steel, — ASTM A 516 Grade 70 12. Spiral case — Carbon Steel, — ASTM A 516 Grade 70 13. Stay ring & stay vane — Carbon Steel, — ASTM A 516 Grade 70 14. Draft tube — Carbon steel — ASTM A516 Gr. 60 or IS 2002 Gr. 3 16. Turbine guide bearing housing — Carbon Steel, — ASTM A 516 Grade 70	Material IS 2062 E250/ E350, IS S235 J2/ S355 J2/ Equivalent for stay ring & Stay Vanes, Spiral Casing, Draft Tube Cone, Bearing Housing, Bottom Ring, Head Cover shall also be acceptable in addition to the mentioned in tender specification as these standard materials for the similar type of Turbines ARE accepted worldwide and the machines running successfully.	Bid provisions are clear
21	Vol-III B (Particular Technical Specifications (PTS), TURBINE AND ACCESSORIES	2.5.3	Material selection and standards	2-13	8. Discharge ring — Stainless Steel, 13Cr-4Ni, — ASTM A240 UNS S41500	As discharge ring is the integral part of the bottom ring, therefore its material shall be the same as for bottom ring i.e. ASTM A 516 Grade 70/ S355 J2/ Equivalent. However, suitable length of the upper cone of draft tube would be of stainless steel material for the application requirement.	Bid provisions are clear
22	Vol-III B (Particular Technical Specifications (PTS), TURBINE AND ACCESSORIES	2.5.4.1	Spiral case	2-14	Spiral case shall be concreted in depressurised condition by the Contractor.	Spiral case shall not be concreted in depressurised condition. It shall be done with partial pressure with respect to the internal design pressure acting on it. Please review the requirement.	Please refer Corrigendum No. 2

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
23	Vol-III B (Particular Technical Specifications (PTS), TURBINE AND ACCESSORIES	2.5.4.4	Pit liner	2-17	The vertical pit liner plate wall shall not be less than 16mm thick.	The vertical pit liner plate wall shall be in the range of 10 to 12 mm thickness. 16 mm thickness is on higher side. Please review the requirement.	Kindly adhere to technical specification.
24	Vol-III B (Particular Technical Specifications (PTS), TURBINE AND ACCESSORIES	2.5.5.1	Draft tube cone	2-17	Two (2) watertight and air tight diametrically opposite manhole doors, having a clear opening of at least 750X750 mm, shall be provided in the draft tube cone.	One number of man hole is sufficient for the all inspection and maintenance purpose in the draft tube cone. Please review the requirement.	Kindly adhere to technical specification.
25	Vol-III B (Particular Technical Specifications (PTS), TURBINE AND ACCESSORIES	2.5.5.2	Head cover	2-19	Design of facing plates shall be such that the replacement of the same shall be carried out without removal of Top Cover. The head cover shall be designed to pass through the wound generator in one piece during erection and dismantling and with the runner and shaft in place.	If head cover would be designed in two or more sections then it is recommended that it shall be pass through the wound generator in sections keeping the generator lower bracket cover size into consideration. However, it would be easily dismantle and assemble in sections. Please review the requirement and confirm.	Kindly adhere to technical specification.
26	Vol-III B (Particular Technical Specifications (PTS), TURBINE AND ACCESSORIES	2.5.6.3	Turbine guide bearing	2-25	For at least (15) minutes at any speed up to 110 percent rated speed and maximum load, without cooling water supply. For fifteen (15) minutes at any speed up to maximum runaway speed, with cooling water supply.	Turbine Guide bearing shall be designed as below to keep the compact design of the bearing system of the power unit. For at least ten (10) minutes at any speed up to 110 percent rated speed and maximum load, without cooling water supply. For five (5) minutes at any speed up to maximum runaway speed, with cooling water supply. The requirement for 15 minutes on higher side, Please review the requirement and confirm.	Kindly adhere to technical specification.
27	Vol-III B (Particular Technical Specifications (PTS), TURBINE AND ACCESSORIES	2.5.6.4	Shaft seals	2-27	The seal shall be so arranged that it may be serviced without disturbing the bearing or dewatering the draft tube.	It shall be noted that the partial dismantling of the turbine guide bearing is required to service the shaft seal. Also, from safety point of view, de-watering of the draft tube is required as considerable head will act on the shaft seal from tail race side during the maintenance/ inspection of the shaft seal.	Kindly adhere to technical specification.
28	Vol-III B (Particular Technical Specifications (PTS)), TURBINE AND ACCESSORIES	2.5.7.4	Turbine pit hoist	2-29	Each turbine pit shall be equipped with the necessary lugs and circular monorails having two nos. cross beams and two hoists covering the entire pit from turbine guide bearing housing to PCD of wicket gate to facilitate easy replacement of all equipment.	It shall be noted that the turbine pit hoist shall be used to handle/ facilitate the small turbine parts like guide vane, shaft seal parts and guide bearing parts etc. The major turbine parts would be handled by the Power House crane only.	Kindly adhere to technical specification.
29	Vol-III B (Particular Technical Specifications (PTS), TURBINE AND ACCESSORIES	2.5.9	Hard Coating	2-35	iii) Top Cover b) Complete area of the facing plates. Iv) Bottom Ring b) Complete area of the facing plates.	It shall be noted that the wetted face of the facing plates shall be HVOF coated only. Please review the requirement and confirm.	Please refer Corrigendum No. 2
30	General				Water Quality Report	Please provide the water quality report with respect to the PH Value, TDS, Electrical conductivity and chloride concentration etc.	Refer report in GTR
31	Vol-III B (Particular Technical Specifications (PTS), (GSU Transformers)	8.5.26	Oil soak pit	8-24	The Scope of E&M contractor shall be connecting pipes from soak pit to main header and main header connection pipe from oil soak pit to oil water separator sump.	Please note that bidder will consider MS pipe for the same . Design of oil water soak pit is not in the scope of bidder. Grating over the soak pit of transformer is not in bidder scope of supply.	Bid provisions are clear
32	Vol-III B (Particular Technical Specifications (PTS), (XLPE Cables)	10.1.1	XLPE Cables	10-1	Eight(8) nos , single phase ,400kV copper conductor , fiber optic embedded XLPE cables of minimum 2000 Sqmm for interconnection with two out going bays…...	Please mention the length of cable to be considered, layout is not clear to estimate the cable length.	Please refer layout dwgs
33	Volume-IV Tender drawings		General		Location of 400kV pothead yard and the 400kV cable tunnel up to pothead yard from Transformer cavern is required for cable estimation. Please provide AutoCAD drg of SLDs and layout		Please refer layout dwgs

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
34	Volume-IV Tender drawings (Single line diagram MV switchgear & Auxiliary transformer- Drg no NH/ DEM/URI/STG II/CP/05) & Single line diagram Unit Aux. board - Drg no NH/DEM/ URI-I/STG-II/LT-01)		General			Rating of UAT is mentioned 500kVA & 800kVA respectively. Please clarify the actual rating to be considered.	Please refer Corrigendum No. 2
35	Volume-IV Tender drawings (220V DC Station Service Drg no NH/ DEM/URI/STG II/CP/01)		General		All outgoing feeders are shown with MCCB feeders	All outgoing feeders are shown with MCCB feeders, requested to consider MCB feeders for control supply to panels , As these are small load feeders considering MCCB to these feders will increase the size of DC board drastically.	Bid provisions are clear
36	Vol-III A (General Technical Specifications (GTS),	5.7.1	General	5-3	Unless otherwise stated, all piping fitting, valves shall be designed for at least 1.5 times of the working pressure but minimum for nominal pressure PN16 and tested with 1.5 times of the design pressure.	All piping, fitting & valves shall be tested at 1.5 times of the design pressure of respective system, kindly accept.	Kindly adhere to technical specification.
37	Vol-III A (General Technical Specifications (GTS),	5.7.2	Valves	5-3	Valve body for oil pipes	For high pressure oil application, carbon steel valve body is acceptable, kindly review the requirement.	Kindly adhere to technical specification.
38	Vol-III A (General Technical Specifications (GTS),	5.7.3	Piping & fittings	5-5	All water and oil pressure pipes shall be seamless type.	For water application, where working pressure is less as compared to high pressure oil application, ERW type pipes shall be used and for oil pressure pipes shall be seamless type, kindly accept.	Kindly adhere to technical specification.
39	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.1.2, 1), b)	Oil pumping unit	3-1	Dual oil filtration unit with changeover facility along with clogging indication	Filter change over shall be through manual valve. Please confirm	Kindly adhere to technical specification.
40	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.1.2, 2)	Oil pumping unit	3-2	Two (2) sets of oil leakage unit, if required	Please be noted that all return lines for servomotor shall be directly connected with main HPU tank so oil leakage unit is not required, please accept.	Bid provisions are clear
41	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.1.2, 4)	Oil pumping unit	3-2	One (1) set of Nitrogen charging kit.	Nitrogen changing kit consist of the requisite hose, adaptor and necessary manifold with isolation valve etc. Same is part of the commissioning spares and shall be supplied along with main system and is common for the plant. Kindly confirm the requirement.	Kindly adhere to technical specification.
42	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.3.3	Capacity	3-7	The rating/capacity of the hydraulic system of the governing system shall not be less than the capacity of the servomotors for operation of the turbine guide vanes.	The rating/capacity of the hydraulic system pumps of the governing system shall not be less than the capacity of the servomotors for operation of the turbine guide vanes, please confirm	Kindly adhere to technical specification.
43	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.3.3	Capacity	3-7	The maximum oil velocity in the pressure pipes lines shall not exceed 3 m/s and 1.5 m/s in return lines.	It is proposed to size the piping as per IEEE 1207, kindly accept.	Kindly adhere to technical specification.
44	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.3.3	Capacity	3-7	The governor oil pressure system shall be designed for the extreme case of closing, opening and final closing of the guide vanes with both oil pumps and nitrogen/oil system inoperative.	The governor oil pressure system shall be designed for the extreme case of closing, opening and final closing of the guide vanes with both oil pumps inoperative, please confirm	Kindly adhere to technical specification.
45	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.5.7.4	Oil sump tank	3-23	The sump tank shall be provided with a manhole of 500 mm diameter with a suitable oil resistant gasket for access to the interior of the tank.	Practically as per the current industry practice, size of manhole with 500 mm Dia is not possible. Kindly update the clause as sufficient diameter manhole for the maintenance requirement to be provided. It shall be of about 400 mm.	Kindly adhere to technical specification.

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
46	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.5.7.4, B)	Proportional valve oil filtering	3-24	Suitable dual on line oil filter with changeover and clogging indication shall be provided in actuator supply circuit to ensure that impurities as recommended by the manufacturer are avoided. .	Two Type of filters shall be provided in the HPU system ; 1. Pressure Line Filter (1W+1S) in pressure line to the main manifold & Accumulator. 2. Offline circuit filter to clean the oil continuously All Filters shall be provided with suitable indication to give alarm in case of filter cloggin, kindly accept	Kindly adhere to technical specification.
47	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.5.8.1	Capacity	3-24	The piston accumulator and N2 bottles shall have a total volume of at least fifteen (15) times the combined active volume of the two gate servomotor cylinders of the turbine and shall be designed for a pressure ten (10) percent above the actual maximum system pressure. The size of the accumulator shall be such that it shall be possible to operate the guide vanes 3 times (2 “C”+1 “O”) from minimum normal oil pressure without the operation of governor oil pumps and without dry nitrogen admission. At the remaining pressure the governing mechanism should still operate with a safe margin.	Specification mentioned under this clause is very much on higher side. Kindly review the requirement. As per the TS two statements are mentioned for the selection of the accumulator station : "1. The Piston accumulator shall have a total volume of at least fifteen (15) times the combined active volume of the two gate servomotor cylinders of the Turbine" This statement is not practically suits for the selection of the high pressure system with N2 based piston type accumulator. in general this statement is used for the Air+Oil vessel design. So kindly delete this line. 2. The size of the accumulator shall be such that it shall be possible to operate the guide vanes three (3) times (2 “C”+1 “O”) from minimum normal oil pressure without the operation of main inlet valve oil pumps and without dry nitrogen admission. We request to accept the accumulator sizing as per Sr. No. 2 above or shall be allowed to use as per IEE125 guidelines.	Please refer Corrigendum No. 2
48	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.5.8.2	Construction and safety features	3-24	The Piston accumulator shall be constructed from plate steel conforming to EN 10028-3 P355NL1 or equivalent in accordance with part UW of the ASME Code for Unfired Pressure Vessels, Section VIII, for the maximum working pressure of the governing system.	Piston accumulator shall be designed and tested in accordance with the pressure equipment directive (PED) - 2014/68/EU. Please accept.	Bid provisions are clear
49	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.5.8.2	Construction and safety features	3-25	In this case, all contacts shall be adjustable electrically separate and suitable for 220 V DC operation.	All contacts shall be adjustable electrically separate and suitable for 24 V DC operation, please accept.	Kindly adhere to technical specification.
50	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.5.8.2	Construction and safety features	3-25	The accumulator shall be equipped with a pressure gauge, a safety relief valve, pressure transducer, oil level sight gauges, metallic magnetic float pipe type with indication, switches and transmitter.	As Level transmitter & level switches shall be provided with accumulator, so oil level sight gauges & metallic magnetic float pipe is not required, kindly accept	Kindly adhere to technical specification.
51	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.5.8.3	Oil pressure piping	3-26	The piping shall be of such size that the maximum oil velocity shall not exceed 3.0 m/sec in the pressure lines and 1.5 m/sec in the return lines.	It is proposed to size the piping as per IEEE 1207, kindly accept.	Kindly adhere to technical specification.
52	Vol-III B (Particular Technical Specifications (PTS), (Digital Governing System and Accessories)	3.8	Spare Parts	3-28	Nitrogen cylinders- Total number required for One (1) unit	Spare nitrogen cylinders are not required, please accept.	Kindly adhere to technical specification.
53	Vol-III B (Particular Technical Specifications (PTS), (Main Inlet Valves and Accessories)	4.5.11.4	Oil sump tank	4-14	The sump tank shall be provided with a manhole of 500 mm diameter with a suitable oil resistant gasket for access to the interior of the tank	Practically as per the current industry practice, size of manhole with 500 mm Dia is not possible. Kindly update the clause as sufficient diameter manhole for the maintenance requirement to be provided. It shall be of about 400 mm.	Kindly adhere to technical specification.

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54	Vol-III B (Particular Technical Specifications (PTS), (Main Inlet Valves and Accessories)	4.5.11.4	Oil sump tank	4-15	Low and high level switches shall be provided for sump tank, suitable for 220 V DC	Low and high level switches shall be provided for sump tank, suitable for 24 V DC, please accept.	Kindly adhere to technical specification.
55	Vol-III B (Particular Technical Specifications (PTS), (Main Inlet Valves and Accessories)	4.5.11.4, A)	Control valve oil filtering	4-15	Suitable dual on line oil filter with changeover and clogging indication shall be provided in main inlet valve actuator supply circuit to ensure that impurities as recommended by the manufacturer are avoided.	Suitable dual on line oil filter with changeover and clogging indication shall be provided in main supply circuit after pump discharge to ensure that impurities as recommended by the manufacturer are avoided, please accept.	Kindly adhere to technical specification.
56	Vol-III B (Particular Technical Specifications (PTS), (Main Inlet Valves and Accessories)	4.5.11.5	Oil leakage unit	4-16	The leakage oil units, if required, shall be provided for the collection of oil leakages from the servomotors and in the event of maintenance for draining the servomotors; oil pipelines and guide bearing.	Please be noted that all return lines for servomotor shall be directly connected with main HPU tank so oil leakage unit is not required, please accept.	Bid provisions are clear
57	Vol-III B (Particular Technical Specifications (PTS), (Main Inlet Valves and Accessories)	4.5.12.1	Capacity	4-16	The piston accumulator and N2 bottles shall have a total volume of at least fifteen (15) times the combined active volume of the two servomotor cylinders of the main inlet valve and shall be designed for a pressure ten (10) percent above the actual maximum system pressure. The size of the accumulator shall be such that it shall be possible to operate the main inlet valve three (3) times (2 “C”+1 “O”) from minimum normal oil pressure without the operation of main inlet valve oil pumps and without dry nitrogen admission.	Specification mentioned under this clause is very much on higher side. Kindly review the requirement. As per the TS two statements are mentioned for the selection of the accumulator station : "1. The Piston accumulator shall have a total volume of at least fifteen (15) times the combined active volume of the two servomotor cylinders of the main inlet valve" This statement is not practically suits for the selection of the high pressure system with N2 based piston type accumulator. in general this statement is used for the Air+Oil vessel design. So kindly delete this line. 2. The size of the accumulator shall be such that it shall be possible to operate the main inlet valve three (3) times (2 “C”+1 “O”) from minimum normal oil pressure without the operation of main inlet valve oil pumps and without dry nitrogen admission. We request to accept the accumulator sizing to operate the main inlet valve two (2) times (1 “C”+1 “O”), kindly accept.	Please refer Corrigendum No. 2
58	Vol-III B (Particular Technical Specifications (PTS), (Main Inlet Valves and Accessories)	4.5.12.2	Construction and safety features	4-16	The accumulator shall be constructed from seamless steel conforming to EN 10028-3 P355NL1 or equivalent in accordance with part UW of the ASME Code for Unfired Pressure Vessels, Section VIII, for the maximum working pressure of the system.	Piston accumulator shall be designed and tested in accordance with the pressure equipment directive (PED) - 2014/68/EU. Please accept.	Bid provisions are clear
59	Vol-III B (Particular Technical Specifications (PTS), (Main Inlet Valves and Accessories)	4.5.12.2	Construction and safety features	4-16	The accumulator shall be equipped with a pressure gauge, a safety relief valve, pressure transducer, and oil-level sight gauge metallic magnetic float pipe type with indication, switches and transmitter.	As Level transmitter & level switches shall be provided with accumulator, so oil level sight gauges & metallic magnetic float pipe is not required, kindly accept	Kindly adhere to technical specification.
60	Vol-III B (Particular Technical Specifications (PTS), (Main Inlet Valves and Accessories)	4.5.12.2	Construction and safety features	4-17	All transmitters shall be 4 to 20 mA type. Contractor is free to use individual suitable pressure and level switches. In this case, all contacts shall be adjustable electrically separate and suitable for 220 V DC operation.	All contacts shall be adjustable electrically separate and suitable for 24 V DC operation, please accept.	Kindly adhere to technical specification.
61	Vol-III B (Particular Technical Specifications (PTS), (Electric Overhead Travelling (EOT) crane)	23.1.2	5 T EOT crane for GIS handling (Single Girder)	23-1	One (1) no. 05 metric tonnes electric overhead travelling bridge crane of span approximately 15.75 m (tentative) complete with electric control panels both pendant and remote radio control, hoist on trolley, brakes, safety devices, platform, ladders, fittings and connections and all necessary accessories	It is proposed to use one (1) 10 tonnes electric overhead travelling bridge crane for GIS handling, kindly accept.	Kindly adhere to technical specification.
62	Vol-III B (Particular Technical Specifications (PTS), (Electric Overhead Travelling (EOT) crane)	23.1.3, iv)	Miscellaneous items	23-2	Load testing of cranes at site including load arrangement and all logistics,	Load arrangement for load testing of crane shall be in customer scope of supply, kindly confirm.	Kindly adhere to technical specification.

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63	Vol-III B (Particular Technical Specifications (PTS), (Electric Overhead Travelling (EOT) crane)	23.5.21.1	Walkways and ladders	23-20	Walkways and ladders	Please be noted that walkway & ladders mentioned under this clause shall be applicable for the walkway structure & ladders in the crane only, same shall be provided by E&M contractor. However ladder required to access the crane from power house service bay/ GIS hall floor shall be provided by Civil /Customer	Kindly adhere to technical specification.
64	Vol-III B (Particular Technical Specifications (PTS), (Cooling water system)	24.1.1	Cooling water system equipments	24-1	One (1) no. per unit automatic self-cleaning filter along with local control panel instrumentation and associated accessories for labyrinths cooling during synchronous condenser mode water circuit	The filtration requirement for labyrinths cooling during synchronous condenser mode water circuit shall be catered by main filters, so please review the requirement.	Kindly adhere to technical specification.
65	Vol-III B (Particular Technical Specifications (PTS), (Cooling water system)	24.2.1 A)	Twin cooling water circuit	24-3	A common make up water tank with automatic self-cleaning fine filters including necessary valves, instrumentation etc. shall be provided for the secondary cooling water circuit by the contractor.	Common makeup water tank shall be in customer scope. Please confirm	Bid provisions are clear Pl refer tender drawing
66	Vol-III B (Particular Technical Specifications (PTS), (Cooling water system)	24.2.1 A)	Twin cooling water circuit	24-3	The raw water for each unit shall be taken from draft tube by centrifugal pumps having automatic self cleaning filters at suction side and automatic self cleaning filter and heat exchanger at outlet	Please be noted that automatic self cleaning filters shall be provided in pump discharge side, in suction side available pressure in the tail pool shall not be sufficient for the autobackwash process. Additionally if required one duplex basket stariner of suitable rating may be provided in the pump suction line tapped from the tail pool. Kindly update the respective clause accordingly.	Kindly adhere to technical specification.
67	Vol-III B (Particular Technical Specifications (PTS), (Cooling water system)	24.3.2	Pumps	24-6	Each Shaft seal cooling water pump shall also cater to shaft seal requirement of two units.	Each Shaft seal cooling water pump shall cater to shaft seal requirement of one unit, as it shall be unitized system, please confirm.	Kindly adhere to technical specification.
68	Vol-III B (Particular Technical Specifications (PTS), (Cooling water system)	24.3.3	Automatic back wash strainer	24-6	The pressure drop across the strainer should be less than approximately 0.3 bar and adequate sensing arrangement shall be provided to sense the pressure drop across the strainer for further integration with plant SCADA system.	0.3 bar pressure drop across strainers will increase the size of filters, kindly accept 0.5 bar pressure drop across strainers.	Kindly adhere to technical specification.
69	Vol-III B (Particular Technical Specifications (PTS), (Cooling water system)	24.3.3	Heat exchanger	24-6	Gap of minimum 10-12 mm in raw waterside and minimum 4-6 mm in secondary water side shall be taken into consideration for designing wide gap plate type heat exchanger.	The gap between plates shall be as per the heat exchanger design requirement, please confirm.	Kindly adhere to technical specification.
70	Vol-III B (Particular Technical Specifications (PTS), (Cooling water system)	24.5.6	Valves and piping	24-8	All embedded and exposed piping shall be of seamless of minimum schedule 80. All gravity drain pipes shall be seamless schedule 40	As the design pressure of cooling water system shall be less, so kindly accept schedule 40 for all the pipes.	Kindly adhere to technical specification.
71	Vol-III B (Particular Technical Specifications (PTS), (Drainage and Dewatering system)	25.3.1	Drainage and Dewatering system	25-6	The design flow rate during dewatering operation shall be calculated to empty remaining water between penstock and draft tube gate in approximately 4 to 6 hours after gravity drainage.	As a general practice the dewatering time of 6 hours shall be considered between MIV up to draft tube gate, which is inline with CEA guide line, kindly accept.	Kindly adhere to technical specification.
72	Vol-III B (Particular Technical Specifications (PTS), (Drainage and Dewatering system)	25.5.3	Valves, Piping and Floor drains	25-8	All embedded and exposed piping shall be of seamless of minimum schedule 80. All gravity drain pipes shall be seamless schedule 40.	As the design pressure of drainage & dewatering system shall be less, so kindly accept schedule 40 for all the pipes.	Kindly adhere to technical specification.
73	Vol-III B (Particular Technical Specifications (PTS), (Drainage and Dewatering system)	25.5.3	Valves, Piping and Floor drains	100/ 284	Valve body of all type of valves shall be preferably of cast steel except smaller valves (50 mm and lower) for which material shall be stainless steel.	Valve body of all type of valves shall be preferably of cast steel, please accept.	Kindly adhere to technical specification.
74	Vol-III B (Particular Technical Specifications (PTS), (Heating Ventilation and air conditioning system)	26.1.5	Auxiliary system and miscellaneous items	106/ 284	Central computerised control panel for HVAC system complete with all wiring, instrumentation and associated accessories etc.	Control panel for HVAC system shall be of hard wire type. Kindly update the clause.	Kindly adhere to technical specification.

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75	Vol-III B (Particular Technical Specifications (PTS), (Heating Ventilation and air conditioning system)	26.5.16	Exhaust Air Fans	118/ 284	Exhaust air fans shall be adjustable axial flow fans. Axial air fans shall be of the multi blade vane type. The vanes shall be adjustable individually at standstill. The hub of the impeller shall be directly coupled to the motor shaft and its diameter adapted to the motor frame. The impeller shall be statically and dynamically balanced.	For Power house all exhaust fans shall be of "Axial Type" as specified in the respective clause. However it is to be noted that fans to be installed in small area like toilets, pantry room, DG room etc. shall be of propeller type and manufacturing shall be as per OEM standard. Kindly accept.	Bid provisions are clear
76	Vol-III B (Particular Technical Specifications (PTS), (Compressed air system)	28.1.1	Compressed Air Systems	28-1	v) Service air hoses of length 30 m with necessary connectors etc. located in wall mounted service air enclosure as per approved drawings	Hose length shall be of 10 m each for service requirement as per standard industry design practice. However it is confirmed that sufficient no. of portable hose connections shall be made available in view of the pant maintenance requirement	Kindly adhere to technical specification.
77	Vol-III B (Particular Technical Specifications (PTS), (Compressed air system)	28.5.2	Compressors	28-5	Each compressor shall be rotary screw type (Oil flooded type), heavy duty and electric driven complete with automatic lubrication, air intake filter, oil filters, after coolers, water/oil separators, discharge valves, non return valves, automatic moisture trap and other associated accessories.	For synchronous condenser operation, high pressor compressor of reciprocating type is applicable, it is requested to update the requirement.	Bid provisions are clear
78	Vol-III B (Particular Technical Specifications (PTS)), (Compressed air system)	28.8	Spare Parts	28-8	Air dryer complete assembly for Main LP and Blow down Air compressor	Air dryer for Blow down Air compressor is not required, kindly update the requirement.	Kindly adhere to technical specification.
79	Vol-III B (Particular Technical Specifications (PTS), (Oil Handling system)	29.5.6	Piping, valves and appurtenances	29-10	Piping, valves and appurtenances	For fire fighting system, the MOC of valves shall be select to meet the system requirement. All valves body shall be of cast steel/ cast iron, internal SS/30% cromium with SS facing, kindly accept	Kindly adhere to technical specification.
80	Vol-III B (Particular Technical Specifications (PTS), (Elevator)	32.5.2.2	Car enclosure	32-4	vi) Emergency Exit on the Car top	Emergency exit on car top is more risky and not recommended by elevator supplier. To access the car top from cabin is itself at challenge for the person to get him self out from the car and moreover after reaching to the car top again person cannot further connect with any of the floor as there shall not be any access ladder in the elevator shaft. Kindly review the requirement and update the respective section accordingly.	Kindly adhere to technical specification.
81	Vol-III B (Particular Technical Specifications (PTS), (Control and monitoring (SCADA) system)	14.1.4	Link between Uri I & Uri I Stage II Power Houses	14-3	i)OFC Terminal Equipment for both the ends. The link has been envisaged through two ADSS Fiber optic cables, each of 12 cores to be laid between Power House of Uri I Stage I & Uri I Stage II including supply of necessary pipes for laying.	Please elaborate the detailed scope of Optical fiber cables for interfacing of different remote locations with plant SCADA system. Kindly specify the followings- 1)Scope of Optical fiber cable in detail between Powerhouse and other remote locations i.e outside power house (e.g Uri I Stage PH) specifying the distances and all details to be considered. 2)We understand Scope of Laying, any accessories required for installation ,any excavation, steel poles, any pipes required shall all be in scope of employer only . 3)Kindly clarify If redundant cores of the same cable can be used for SCADA communication. Please accept the same. We understand that optical fiber specified in the clause is related to control and monitoring purpose only. Further note that Any route survey ,clearance if any,excavation,installation of HDPE,pipes,poles (if any),civil work,laying,erection of work required for such external fiber optic cables shall be in customers scope only.	Kindly adhere to technical specification.

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82	Vol-III B (Particular Technical Specifications (PTS), (Control and monitoring (SCADA) system)	14.1.5	All Dielectric self supporting Optic Fiber cable	14-3	All ADSS optical fiber link shall be provided between power house and admin building in colony The detail of route/arrangement shall be provided during detailed engg the link shall be complete in all respects, comprising but not limited to following: a)ADSS cable (minimum 12 core) b)RTU equipment/optical modem all necessary accessories including UPS,interfacing equipment etc,for real time dual window single mode (DWSM) communication between above location c)All allied works for erection of ADSS cable as required Steel poles (if any required) for laying of ADSS cable shall be supplied and erected by the employer.	Please elaborate the detailed scope of Optical fiber cables for interfacing of different remote locations with plant SCADA system. Kindly specify the followings- 1)Scope of Optical fiber cable in detail between Powerhouse and other remote locations i.e outside power house (e.g Admin building) specifying the distances and all details to be considered. 2)We understand Scope of Laying,any accessories required for installation ,any excavation, steel poles required shall all be in scope of employer only .. 3)Kindly clarify If redundant cores of the same cable can be used for SCADA communication. Please accept the same. We understand that optical fiber specified in the clause is related to control and monitoring purpose only. Further note that Any route survey ,clearance if any,excavation,installation of HDPE,pipes,poles (if any),civil work,laying,erection of work required for such external fiber optic cables shall be in customers scope only.	Bid provisions are clear
83	Vol-III B (Particular Technical Specifications (PTS), (Control and monitoring (SCADA) system)	14.5.5.5	Temperature Measurement	14-30	A temperature scanner and printer shall be installed for the winding and bearing temperatures including all necessary sensor cabling.	As our system have PT100 Cards which directly takes the RTD signals in the IO racks which is connected to controller via redundant bus. Voith assures that all temperature measurements shall be available on the HMI of the UCB as well as in CCR and shall be printed out in the control room on demand. Voith request customer to consider the same.	Please refer Corrigendum No. 2
84	Vol-III B (Particular Technical Specifications (PTS), (Control and monitoring (SCADA) system)	14.5.6.2	LCB for Common & Station Services & Dam control	14-31	ix)Dam Monitoring	Kindly clarify how Dam site shall be linked to power house. Shall employer provide any OPGW /OFC link and RTU for the same. Kindly clarify scope regarding the same.	Bid Provisions are clear. Dam site shall be linked through Uri I Stage I Power house. OFC and associated equipments for link between the two power houses is in the scope of contractor.
85	Vol-III B (Particular Technical Specifications (PTS), (Control and monitoring (SCADA) system)	14.5.12.6	Communication interfacing	14-41	Dedicated bandwidth VSAT/Leased line communication	Our understanding is that the bidders scope is limited to - The Router / Gateway station at power house only, NHPC VSAT Device and Communication Link as stated in the bid document shall be in Customer Scope. Kindly confirm the same	Bid Provisions are clear
86	Vol-III B (Particular Technical Specifications (PTS), (Control and monitoring (SCADA) system)	14.5.13	Audio visual alarm system	14-41	Each Local Control Board shall have its independent facilities for Alarm and Annunciation. The system shall be complete with Horns, alarm network/cabling etc	Kindly note Alarm and visual alarms shall be visualized on HMI screen provided on each LCB .with its hooter.Kindly accept the same.	Bid Provisions are clear
87	VOLUME – IV: Tender Drawings		General			Please arrange to provide the tender drawing in AutoCAD format for our consideration. Shared tender documents are not legible so requesting you to please share the editable copy of the tender documents.	PDF drawings are attached. Please refer Corrigendum No. 2
88	VOLUME- V Forms and procedures		General			Requesting you to please provide the editable copie of Forms	Please note, referred volume is an editable PDF document.
89	Volume - III C Technical Data sheets		General			Requesting you to please provide the editable copies of Technical Data sheets	Please refer revised and substituted volume-III C

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90	Volume-IIA (GCC)	23.2	Test and Inspection	Page 53 of 117	Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a (three) 3 weeks advance notice of such test and/or inspection and of the place and time thereof to the Engineer In-Charge.	Requested to you kindly allow the 2 weeks for advance notice for witness the inspection stage.	Please adhere to bid conditions.
91	Volume-III D	1.2.5	Impact and Bend Tests	Page 7of 306	Steel products for all principal turbine and shut-off valve parts shall be tested for impact resistance using the ISO V-notch specimen. Both longitudinal and transverse impact tests shall be performed on plate steel. Bend tests shall be performed on specimens of all major steel castings and forgings in accordance with the applicable DIN standards. The nil ductility transition temperature shall be the temperature at which the impact resistance is at the values specified above.	Please note that all chemical & Mechanical testing to be performed according to specified material standard.	Please refer Corrigendum No. 2
92	Volume-III D	1.2.6.2.	Examination of Casting	Page 7of 306	The turbine runner casting shall be given complete non-destructive examination including radiographic examination of the most critical areas.	Ultrasonic test is giving the same results efficiently as Radiographic testing (RT) on the castings & globally used to detect internal discontinuties as per quality sheet. RT is not preferred due to health hazards and UT in lieu of RT is globally accepted by other customer hence request to please accept here also.	Please adhere to bid conditions.
93	Volume-III D	4.1	Type Test	Page 24 of 306	The contractor is required to carry out all type tests as per relevant National/ International Standards on one apparatus of each type of similar rating and shall submit the reports to the Employer. The type test may not be mandatory if similar equipment has been type tested and test certificate (s) for relevant tests are accepted by the Employer. Moreover Applicability of type test reports shall be governed as per the prevailing CEA norms. Type test reports of the following items shall be submitted for acceptance with adequate details/ drawings to establish equivalence with offered type: • Bye pass valve and air release valve • Servomotor • Pump and motor for oil pressure unit • Other items felt necessary during detail engineering.	Please note that Type test report to be provide for Motor only for other Items(Valves,Servomotor,Pumps) Type Test is not applicable as per relevant standard being a mechanical items. However routine test report will be submitted as per applicable standard. Kindly accept the same.	Please adhere to bid conditions.
94	Volume-III D	5.3	Generator, Field Tests	Page 27,25 of 306	Following tests in operation without any harmful damage to the machine: • Guide bearings and the thrust bearing to be able to operate for 15 minutes at rated conditions without any water cooling auxiliaries,	Please note that no need for performed mentioned test because these parameters & conformity to be proven based on design calculation. So please accept the same.	Field Tests shall be carried out as per approved field tests Plan agreed between Contractor & Engineer-In-Charge at Site as mentioned in QTS.Hence Bidders are requested to adhere Model Quality Assurance Plan (MQAP)/ Quality Testing Specification(QTS).
95	Volume-III D	24.1	Type Test of Cooling Water system	Page 59 of 306	Type Test The contractor is required to carry out all type tests as per relevant National/ International Standards on one apparatus of each type of similar rating and shall submit the reports to the Employer. The type test may not be mandatory if similar equipment has been type tested and test certificate (s) for relevant tests are accepted by the Employer. Moreover Applicability of type test reports shall be governed as per the prevailing CEA norms. Type test reports of the following items shall be submitted for acceptance with adequate details/ drawings to establish equivalence with offered type: • Pump and motors. • Other items felt necessary during detail engineering	Please note that Type test report to be provide for Motor only for other Items(Pumps) Type Test is not applicable as per relevant standard being a mechanical items. However routine test report will be submitted as per applicable standard. Kindly accept the same.	Please adhere to bid conditions.
96	Volume-III D	24.3	Field Test	Page 59 of 306	Operational Test on Pump-Motor Assembly for measurement of Head, Rate of Flow, Speed, Power Input & Efficiency	Please not that Efficiency test is not envisazed at site same to be performed at manufacturer works so no need at site. Other rest tests will performed at site. Kindly accept the same.	Please refer Corrigendum No. 2

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97	Volume-III D	25.1	Type Test of Drainage & Dewatering System	Page 63 of 306	25.1 Type Test The contractor is required to carry out all type tests as per relevant National/ International Standards on one apparatus of each type of similar rating and shall submit the reports to the Employer. The type test may not be mandatory if similar equipment has been type tested and test certificate (s) for relevant tests are accepted by the Employer. Moreover Applicability of type test reports shall be governed as per the prevailing CEA norms. Type test reports of the following items shall be submitted for acceptance with adequate details/ drawings to establish equivalence with offered type: □ Submersible pumps and motors. □ Power cable and control cable for submersible pump. □ Valves and other items felt necessary during detail engineering.	Please note that Type test report to be provide for Motor only for other Items(Valves, Pumps) Type Test is not applicable as per relevant standard being a mechanical items. However routine test report will be submitted as per applicable standard. Kindly accept the same.	Please adhere to bid conditions.
98	Volume-III D	25.3	Field Test	Page 63 of 306	Operational Test on Pump-Motor Assembly for measurement of Head, Rate of Flow, Speed, Power Input & Efficiency.	Please not that Efficiency test is not envisazed at site same to be performed at manufacturer works so no need at site. Other rest tests will performed at site. Kindly accept the same.	Please refer Corrigendum No. 2
99	Volume-III D		Model QAP Francis Turbine & Accessories - Stay Ring & Spiral Casing	Page 2 of 21	f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP	Please note that in case of Plate,Pipe Material Test to be conduct in NABL Lab if Mill Test certificate is not available. Kindly accept the same.	Please adhere to bid conditions.
100	Volume-III D	3.8	Francis Turbine & Accessories -Turbine Shaft	Page 16 of 21	Proof Assembly of Turbine shaft with Runner to check the fitment & alignment (As applicable)- For 1st unit #	Please note that this is a Big size machine where the size of Runner and Shaft are Huge and weight of assembly will be too heavy which is not feasible to handle together in workshop and also not recommended from safety point of view. Secondly, the drilling in shaft & Runner is done using the drilling template . This is the globally acceptable manufacturing technique to ensure interchangeability. This is also the Voith standard proven design in all projects. So trail shop assembly of Turbine Shaft with Runner is not required. Kindly accept the same.	Please adhere to bid conditions.
101	Volume-III D	5.2	Model QAP-Over Speed Control Device with Turbine Shaft	Page 20 of 21	Performance Test	This Test is not envisaged at shop, same to be performed at site, kindly accept the same.	Please adhere to bid conditions.
102	Volume-III D	B . ii)	Model QAP-Generator -Stator Punching	Page 3 of 19	B- In Process - ii) Stacking factor	Please note that as per applicable standard Stacking Factor to be checked at raw material stage when the material is non-insulated . The same is already mentioned at raw material stage in Model QAP. During final stage of inspection, the stator punching is insulated so this test is not applicable as per applicable material standard.	Please refer Corrigendum No. 2
103	Volume-III D	B . ii)	Model QAP-Generator -Stator Punching	Page 3 of 19	B- In Process:- iv) Specific Total Loss v) Magnetic Polarization vi) Waviness & Packet Size & Height	Please note that iv) Specific Total Loss v) Magnetic Polarization vi) are part of Raw material test which are mentioned in Raw Material stage so no need in process stage. vi) Waviness & Packet Size & Height - are part of Assembly stage which to be conduct at site.	Please refer Corrigendum No. 2
104	Volume-III D	B . i) & ii)	Model QAP-Generator- Unwound Stator	Page 4 of 19	Core Assembly i) Dimension Check (Check of core for waviness, core dia,packet size and Height after assembly) ii) Core Loss Test and Hot Spot detection	Please note that these test to be conduct at site after assembly and so same to be covered in Field Quality Plan during detail Engg. Kindly accept the same.	Please adhere to bid conditions.
105	Volume-III D	A. ii)	Model QAP - Stator Winding Bar	Page 5 of 19	1 Raw Material ii) Electrical Resistivity Test	Please note that this test to be covered Model QAP clause B v).	Please refer Corrigendum No. 2
106	Volume-III D	B. iii)	Model QAP - Stator Winding Bar	Page 5 of 19	B. iii) Break Down Voltage test at Room Temperature & rated temperature	Please note followings: -Insulated strand (component of final product stator bar) is made of Copper and Insulation on it. OEM's use their own proven qualified insulation technology for strands as well as final product. The insulation materials in component levels are as per OEM practices and is proven and qualified. The insulation on the strand is also qualified as per OEM practice which meets the final product insulation requirements. -Micalastic® Insulation technology is used by VOITH and Siemens globally including in Indian projects viz. Baglihar (Stage-1 & Stage-2), Karcham Wangtoo, Omkareshwar, Sainj and others which are running successfully. -In the above insulation technology, the strand insulation breakdown voltage test is performed at room temperature and never tested and not required at higher temperatures. With above, VOITH request to accept the tests on insulated strands at room temp. inline with its standard practice.	Please adhere to bid conditions.

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107	Volume-III D	B	Model QAP - Stator Winding Bar	Page 6 of 19	B Mica Tape Resin Content (for Resin Rich only) v)Voltality Content viii)Resin Flow Rate	As per BID Documents as Volume -III B (PTS) Clause 5.5.5.3 of Stator Winding page no 5 of 9, Stator Bars shall be manufactured by VPI technology. For VPI bars, these tests are not applicable.	Please adhere to bid conditions.
108	Volume-III D	3.ii)	Model QAP - Stator Winding Bar	Page 6 of 19	3) ii)Final Inspection - Stator Winding Bar iv) Impulse Voltage withstand Test	Please note that Impulse Voltage Test: This is type test of insulation process, So Test certificate of earlier executed test is acceptable. Kindly confirm the same.	Please adhere to bid conditions.
109	Volume-III D	3.iv)	Model QAP - Stator Winding Bar	Page 6 of 19	3) iv) IR after HV Test	Please note that IR test of individual bar is not feasible at shop floor and also not in VOITH standard guidelines however IR test is conducted at site and same will be part of Field Quality plan. Kindly accept the same.	Please adhere to bid conditions.
110	Volume-III D	A.iii)	Model QAP - Generator - Rotor rim assembly	Page 8 of 19	iii) Electrical Properties	Please note that for High Tensile Magnetic Steel Sheet magnetic properties are applicable as per international standards and will be provided. Kindly confirm the same.	Please adhere to bid conditions.
111	Volume-III D	A.iii)	Model QAP- Generator -Pole Assembly	Page 9 of 19	iii) Electrical Properties	Please note that Electrical properties are applicable for Pole coils and Damper Bars. Kindly confirm the same.	Please adhere to bid conditions.
112	Volume-III D	B . iii) & v)	Model QAP- Generator -Pole Assembly	Page 9 of 19	B-v) Milivolt Drop Test	Please note that Milivolt Drop test is conducted when all poles are connected in the wound stator at site.Milivolt Drop test is not feasible to conduct at shop.	Please adhere to bid conditions.
113	Volume-III D	A.iii) , B.iii)	Model QAP-Generator - Shaft (Top & bottom)	Page 11 of 19	Raw Material - Mechanical Properties Inprocess inspection -Mechanical Properties after Heat Treatment-axial, radial, tangentia	Please note that Mechanical Testing to be performed after Heat treatment one time only. and applicable material standard defines the type of tests and quantum of tests. It is requested to follow the material standard requirements as a standard practice..	Please adhere to bid conditions.
114	Volume-III D	B.iii)	Model QAP - Generator- Brake & Jacking	Page 13 of 19	Brake and Jacking System (Brake-Jack Assembly, Brake-Jack Control Panel, Brake Liner) Final Inspection - UT of Brake Liner	UT is not applicable in Brake Liner/Brake Pad because it is not materiac parts. So kindly confirm the same.	Please adhere to bid conditions.
115	Volume-III D	C.iii)	Model QAP - Generator- Brake & Jacking	Page 13 of 19	Brake & Jack Control Panel - iii) IR & HV Test	Please note HV/IR test is not applicable for Brake & Jack Control Panel. Kindly accept the same.	Please adhere to bid conditions.
116	Volume-III D	B. vii)	Model QAP - Generator - Thrust Bearing	Page 15 of 19	vii) Runout Check of Shaft with Thrust Collar Assembly	Please note that thrust collar is fitted with shaft by shrink fitting process which is only done at site after putting the shaft in position. So this test is not applicable at shop. Combined run out is checked at site as a regular practice.	Please adhere to bid conditions.
117	Volume-III D	B. iii)	Model QAP- Generator- Guide Bearing (Upper & Lower) Pads	Page 16 of 19	Trial assembly of complete Bearing	Please not that Trial assembly of complete bearing is not envisaged in workshop because some items like Internal Cooler, Thrust & Guide Pads are manufactured at different location and different time scheduled so Trail assembly of Upper & Lower Bearings will be done in works without Coolers, Guide & Thrust Pad & other small bought out items as instruments. Kindly confirm.	Please refer Corrigendum No. 2
118	Volume-III D	B.iv)	Model QAP- Generator - Air & Oil Coolers	Page 18 of 19	Trial assembly of oil coolers (or dummy frame) in Upper and Lower Brackets	Please note that assembly of Oil collers is flexible / adjustable type in the bearing brackets which can easily been done at site. This is general standard practice Voith follow the same in all Projects. So no need trial assembly in workshop. Kindly accept the same.	Please adhere to bid conditions.
119	Volume-III D	3.5 c)	Model QAP- EOT Crane	Page 3 of 4	Operational/functional test - CT travel test at 125% of rated load	Please note that CT travel test at 125% of rated load is not envisazed at manufacturer works. same to be done at site. Kindly accept the same.	Please adhere to bid conditions.
120	Volume-III D	2.5 i),ii) & iii)	Model QAP- Service Elevator	Page 4 of 4	2.2 Satisfactory Operation of each controller, switch, contactor, starter, retiring cam,relay & other control devices and the correct operation of all limit switches under the most unfavorable conditions. 2.5 IR & HV Test for Control Panel i) Between the live parts & case or frame with all circuits completed. ii) Between main terminals or equivalent parts with all circuits open. Iii) Between any live parts of independent circuits	2.2- Please note that the Elevator is completely assembled and operation checked at site. At shop floor the operation of the controlar & other parts are done to simulation process as a standard practice. 2.5- HV IR test of the individual control panel will be done at shop. but the HV Test of 2.5 i),ii) & iii) can only be done at site which will be covered in Field Quality plan separately.	2.2- Agreed. 2.5- Agreed. Please refer Corrigendum No. 2
121	VOLUME – III D: Quality Test Specifications (QTS) & Model Quality Assurance Plan (MQAP) - Bus Duct	7.1	Type Tests	Pdf Page 31/306	Temperature Rise Test Short Time Current Test Impulse Voltage Tes	VHN propose to accept slightly lower and higher rating of type test reports conducted earlier on bus duct for review. Kindly accept.	Please adhere to bid conditions.

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
122	VOLUME – III D: Quality Test Specifications (QTS) & Model Quality Assurance Plan (MQAP) - Generator Transformer	8.1	Type Tests	Pdf Page 32 /306	Temperature rise test Measurement of Power taken by liquid pump motors Determination of Sound leve	VHN propose to accept slightly lower and higher rating of type test reports conducted earlier on bus duct for review. Kindly accept.	Please adhere to bid conditions.
123	VOLUME – III D: Quality Test Specifications (QTS) & Model Quality Assurance Plan (MQAP) - Bus Reactor	9.1	Type Tests	Pdf Page 34 /306	Temperature rise test Measurement of Vibration Measurement of acoustic sound level Dielectric Test Measurement of power consumption of oil pump	VHN propse to accept slightly lower and higher rating of type test reports conducted earlier on bus duct for review. Kindly accept.	Please adhere to bid conditions.
124	VOLUME – III D: Quality Test Specifications (QTS) & Model Quality Assurance Plan (MQAP) - DC System	13.1	Type Tests	Pdf Page 34 /306	AC & DC distribution boards	Kindly note that AC & DC Distribution consists only MCBs . Therefore, VHN will provide applicable IP certificates for review. Kindly accept.	Please adhere to bid conditions.
125	VOLUME – III D: (QUALITY ASSURANCE PLAN) : MODEL- Static Excitation System	A.1	Bought Out items	Pdf Page 131 /306	Thyrister, Transistor, PCB, Zenor Diode, Heat Sink, Filter Surge Suppression, Device etc	Kindly note all these components are integral part of Converter system/ Thyristor bridge, Therefore, Test certificate of Converter system/ Thyristor bridge system shall be provided for review.	Please refer Corrigendum No. 2
126		B	Monitoring & Protection	Pdf Page 132 /306	Monitoring & Protection b) Thyristor Failure Detection c) DC Short Circuit Test e) Transient Over Voltage due to lighting or Switching Surges	TC / Declaration of conformity for the device and SICROBAR shall be provided.	Please adhere to bid conditions.
127		C.9	Final Inspection of Excitation System	Pdf Page 133 /306	Functional Check of Discharge Ckt. and Field Over voltage Protection	Kindly note, It is not feasible to simulate. Circuit will be verified in accordance with Circuit diagram	Please adhere to bid conditions.
128		C. 12	Final Inspection of Excitation System	Pdf Page 133 /306	Nominal Exciter response Test	Only calculation shall be provided	Please adhere to bid conditions.
129		C-13	Final Inspection of Excitation System	Pdf Page 133 /306	Positive & Negative Ceiling Voltage & Current Test	Positive & Negative Ceiling Current test is not feasible in factory. Same can be demonstrated at site on actual machine.	Please adhere to bid conditions .
130		C-15(c)	Final Inspection of Excitation System	Pdf Page 133 /306	c) Rectifier Leakage Test	Only Test certificate shall be shared for review.	Please adhere to bid conditions .
131		C-15(f)	Final Inspection of Excitation System	Pdf Page 134 /306	Polarity and Phase Relationship	This test is not applicable	Please adhere to bid conditions.
132		C-15(g)	Final Inspection of Excitation System	Pdf Page 134 /306	Range & Stability of Rectifier Control	This test is feasible at Site.	Please adhere to bid conditions.
133		C-17	Final Inspection of Excitation System	Pdf Page 134 /306	Heat Run Test on Thyristor Bridge	We propose to accept equivalent type test report for review.	Please adhere to bid conditions.
134		A.4	Raw Material	Pdf Page 136 /306	Fibre glas sheet / Insulation Barrier	COC shall be provided. Kindly accept.	Please refer Corrigendum No. 2
135		B.4	Raw Material	Pdf Page 137 /306	PTC Thermistor with Alarm and Trip Device	This is not applicable.	Please refer Corrigendum No. 2
136		B.5	Raw Material	Pdf Page 137 /306	Off Circuit Tap Changer: a) Routine test	Please note that this will be small copper link for which no supplier provides / conduct routine test. Hence, it is not feasible to provide TC. Kindly accept.	Please adhere to bid conditions
137		C. 3 (d)	Inprocess Inspection	Pdf Page 138 /306	In-Process Capacitance before and after Clamping	This test is not applicable.	Please adhere to bid conditions.
138		C1 (a, b)	Final Inspection of Transformer	Pdf Page 139 /306	a) Temperature Rise Test b) Full wave Lightning Impulse Test(LI)	We propose to accept equivalent type test report for review.	Please adhere to bid conditions
139		C3(c,d)	Final Inspection of Transformer	Pdf Page 139 /306	Determination of Sound Level Deterination of Transient voltage Transfer Characteristics	We propose to accept equivalent type test report for review.	Please adhere to bid conditions.

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
140	VOLUME – III D: MODEL QUALITY ASSURANCE PLAN (QAP) FOR BUS DUCT	A.1.1(d)	Aluminium for Enclosure	Pdf Page 141 /306	A-1.1 Aluminium for Enclosure d) Conductivity	This test is not applicable on bus duct enclosure.	Please adhere to bid conditions.
141		A. 1.3(d, e)	Epoxy Insulator	Pdf Page 141 /306	d) Bending Resistance Test e) Thermal Shock test	These test are not applicable. Kindly accept.	Please adhere to bid conditions.
142		3. I (3.1- 3.3)	Type Tes	Pdf Page 142 /306	Temperature Rise Test Short Time Current Test Impulse Voltage Test	VHN propose to accept equivalent/ higher rating type test report for review. Kindly accept.	Please adhere to bid conditions .
143		3. II (3.8)	Routine Test	Pdf Page 142 /306	Mili Volt Drop Test	Kindly note that as per IS: 8084, Milli-Volt drop test is not a part of routine test. Therefore, Same shall be performed on any one sample. Kindly accept.	Please adhere to bid conditions.
144	MODEL QUALITY ASSURANCE PLAN (QAP) FOR LAVT & NG CUBICLE	B.2.3	Current Transformer	Pdf Page 145 /306	Type Test (Impulse & Temp. Rise Test)	Kindly note that as per IEC 61869-1, Table-2, Lighting Impulse Test is applicable for equipment intended for use of system with rated voltage above 3.6 kV.	Please adhere to bid conditions.
145	MODEL QUALITY ASSURANCE PLAN (QAP) FOR GSU TRANSFORMER	1.3 (a, b)	Air leakage Test on Tank & Conservator	Pdf Page 149 /306	Air Leakage Test on Transformer and Conservator a) Leak proofness test for Tank and conservator for 35 KN/ Sq. mm Pressure b) Vacuum withstand test for one Hour and permanent deflection measurement of flat plate.	Please note that as per CBIP manual of Transformer, this is a design test. Therefore, Test will be applicable on only one tank / design. Kindly accept.	Please adhere to bid conditions.
146		4.3	Insulating Oil	Pdf Page 150 /306	Insulating Oil	We propose to accept manufacture's certificate in place of conducting the test.	Please adhere to bid conditions.
147		5.1 (a)	Paper Insulated Copper Conductor (PICC)	Pdf Page 151 /306	Conductor dimensions (bare), Paper Covering arrangement, Resistivity, Tensile Strength & Elongation, Visual check for Surface Finish, Corner radius	We propose to accept manufacture's certificate in place of witnessing the test.	Please adhere to bid conditions.
148		6.1(a-d)	Core & Coil assembly(CCA)	Pdf Page 151 /306	Core & Coil assembly(CCA) -(a-d)	We propose to accept Internal report in place of Witnessing the test.	Please adhere to bid conditions.
149		7.3 (b)	Surge Arrestor Gas Type (If applicable)	Pdf Page 153 /306	Acceptance Test	Please note that this is a bought out item. Therefore, Acceptance test is not feasible. Routine test certificate shall be provided.	Please adhere to bid conditions.
150		7.24	Oil level indicator	Pdf Page 154 /306	Oil level indicator	Please note that no manufacturer provides certificate for this non critical item.	Please adhere to bid conditions.
151		8.B (a-d)	Type Test	Pdf Page 156 /306	Type Test: a) Temperature Rise Test b) Determination of Sound level	VHN proposed to accept similar / higher rating Type test reports for review. Kindly accept.	Please adhere to bid conditions.
152		8.C (a-g)	Special Test	Pdf Page 156 /306	SPECIAL TESTS:	We propose to accept similar / higher rating reports for review in place of witnessing the test. Kindly accept.	Please adhere to bid conditions.
153		8.C (h)	Special Test	Pdf Page 156 /306	Routine & Functional Test of Nitrogen Injection Fire Protection System (NIFPS)	Routine test / Functional test of Nitrogen Injection Fire Protection System is not feasible at works due to works limitation . Functional test will be demonstrated at site during commissioning. Kindly accept.	Please adhere to bid conditions.
154		8.C (h)	Special Test	Pdf Page 156 /306	Online Moisture Monitoring & DGA analyser functional test	Please note that functional test of DGA is not feasible at works. Functional test will be demonstrated at site. Kindly accept.	Please adhere to bid conditions.
155		8.C (j)	Special Test	Pdf Page 156 /306	Functional check of PRD	Kindly note that PRD will be Pressure tested in loose condition. Kindly accept.	Please adhere to bid conditions.
156		8.C (k)		Pdf Page 156 /306	Functional check of Sudden Pressure relay	SPR comes duly tested from the manufacturer. TC for the same will be shared for review. Kindly accept.	Please adhere to bid conditions.
157	MODEL QUALITY ASSURANCE PLAN (QAP) FOR BUS REACTOR	1.3 (a, b)	Air leakage Test on Tank	Pdf Page 158 /306	Air Leakage Test on Transformer and Conservator a) Leak proofness test for Tank and conservator for 35 KN/ Sq. mm Pressure b) Vacuum withstand test for one Hour and permanent deflection measurement of flat plate.	Please note that, this is a design test. Therefore, Test will be applicable on only one tank / design. Kindly accept.	Please adhere to bid conditions.

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
158		4.3	Insulating Oil	Pdf Page 159 /306	Insulating Oil	We propose to accept manufacture's certificate in place of conducting the test.	Please adhere to bid conditions.
159		6.1 (a-d)	Core & Coil assembly.	Pdf Page 161 /306	Core & Coil assembly (a-d)	VHN proposed to accept test report carried out by the manufacturer in place of witnessing the test. Kindly accept.	Please adhere to bid conditions.
160		8	Type and Special Test	Pdf Page 165 /306	Type Test: a) Temperature Rise Test b) Measurement of Vibration c) Determination of Sound level Special Test a) Measurement of zero-sequence reactance b) Measurement of mutual reactance c) Measurement of harmonics of the current d) Determination of linearity of reactance e)Measurement of magnetic characteristic	VHN proposed to accept similar / higher rating Type test reports for review. Kindly accept.	Please adhere to bid conditions .
161		8	Special Test	Pdf Page 165 /306	h) Routine & Functional Test of Nitrogen Injection Fire Protection System (NIFPS) Test i) Online Moisture Monitoring & DGA analyser functional test	Please note that functional test of both NIFPS & DGA is not feasible at works due to works limitations.. Therefore, Functional test of these components would be demonstrated at site. Kindly accept.	Please adhere to bid conditions.
162				Pdf Page 165 /306	h) Jacking Test i) Dye penetration Test after Jacking Test	Kindly note that test performed during fabrication stage shall be shared for review. Kindly accept.	Please adhere to bid conditions.
163	MODEL QUALITY ASSURANCE PLAN (QAP) FOR 400 kV XLPE cable	1.1	Copper conductor	Pdf Page 167 /306	Diameter, Surface Condition, Tensile & Elongation Test & Chemical Composition	Please note that Manufacture's test certificate for Mechanical & Chemical Properties shall be provided for copper rod. Kindly accept.	Please adhere to bid conditions.
164		1.3	Internal & External Semiconductive shield	Pdf Page 167 /306	Viscosity, Scroch Time, Rheometer, Transversal Resistivity, Density	Please note that only Material TC with Density shall be provided.	Please adhere to bid conditions.
165		1.4	XLPE Compound	Pdf Page 168 /306	Tensile Strength, Permittivity, Dielectric Loss angle	Please note that instead of Tensile Strength, Permittivity, Dielectric Loss angle, XLPE Insulation TC for Density, Water Containt & Volume Resisitivity shall be provided. Kindly accept.	Please adhere to bid conditions.
166		2 (g)-ii	Electrical Type Test on Cables	Pdf Page 169 /306	g(ii) High Voltage Test in water Immersion	As per IEC 62067, this test is not applicable.	Please refer Corrigendum No. 2
167		5(f)	Acceptance Test	Pdf Page 170 /306	f) IR & HV Test	As per IEC 62067, this test is not a part of sample test.	Please refer Corrigendum No. 2
168		5(i)	Acceptance Test	Pdf Page 171 /306	i) Water Containt Test	As per IEC 62067, this test is not a part of sample test.	Please adhere to bid conditions
169		5(k)	Acceptance Test	Pdf Page 171 /306	J) Lightning Impulse Voltage Test followed by a power frequency test	Please note that this test is applicable on 01 length, if cable length will lies between 04 Km and 20 Km as per IEC 62067 . Further, it is only Lightning impulse test as per applicable IEC. Kindly accept.	Please adhere to bid conditions
170		6 (a-h)	FRLS Test	Pdf Page 171 /306	FRLS Test (a-h)	As per IEC 62067, These tests are not applicable.	Please adhere to bid conditions
171	MODEL QUALITY ASSURANCE PLAN (QAP) FOR 420KV GIS SYSTEM	6(C)-1-9 ,	Routine Tests	Pdf Page 177 /306	C. Current Transformer (1-9)	Please note that CT is bought out items.Thereforefore, we propose to accept Routine TC for review. Kindly accept.	Please adhere to bid conditions.
172		6(D)-1-6,	Routine Tests	Pdf Page 178 /306	D. Voltage Transformer (1-6)	Please note that VT is bought out items.Thereforefore, we propose to accept Routine TC for review. Kindly accept.	Please adhere to bid conditions.
173		E(3-4)	Acceptance Tests	Pdf Page 179 /306	E. Surge Arrester	Please note that Surge Arrester is bought out items.Thereforefore, we propose to accept Routine TC for review. Kindly accept.	Please adhere to bid conditions.
174	MODEL QUALITY ASSURANCE PLAN (QAP) FOR DC System - INVERTER	D(15-17)	FINAL INSPECTION	Pdf Page 183 /306	15)Parallel Redundant UPS Fault Test 16) Current Division in Parallel UPS 17) Unbalanced/Balanced Load Test	Kindly note that these test will be applicable for 3-Phase Inverter not for 1-Phase..	Please adhere to bid conditions
175		D 21	FINAL INSPECTION	Pdf Page 183 /306	Heat Run Test	We propoose to accept Equivalent type test report. Kindly accept.	Please adhere to bid conditions

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176	MODEL QUALITY ASSURANCE PLAN (QAP) FOR UPS	B-2	FINAL INSPECTION	Pdf Page 183 /306	Functional Check including battery back-up test, alarm / indication test and protective functions	Functional Check on UPS with battery back up is not feasible at works. same shall be demonstared at site. Kindly accept.	Please refer Corrigendum No. 2
177	MODEL QUALITY ASSURANCE PLAN (QAP) FOR: DC System - AC & DC DISTRIBUTION BOARD	3	Components	Pdf Page 185 /306	Components - DC contactors, Indicating lamps ,MCB,MCCB, Fuse,Switch,Push Buttons, Meters, Lamps, Electronic card onvertor & Diode (applicable for 220/48V DC-DC convertor	Please note that AC & DC Distribution Board having only MCB. Therefore, other components are not applicable. COC shall be provided for the same. Kindly accept.	Please refer Corrigendum No. 2
178	MODEL QUALITY ASSURANCE PLAN (QAP) FOR: 220V BATTERY CHARGER	2 (a)	Cables	Pdf Page 187 /306	a) Surface defects	Kindly note that Surface defect is not a part of routine test as per IS: 694.	Please refer Corrigendum No. 2
179		5(b)	Type Test	Pdf Page 188 /306	b) Power Loss determination for assemblies and equipments	Please note that Power Loss determination for assemblies and equipments is not applicable.	Please adhere to bid conditions
	MODEL QUALITY ASSURANCE PLAN (QAP) FOR CABLING SYSTEM						
180	11 kV XLPE cable	A. 1(b)	Copper Conductor / Rod	Pdf Page 202 /306	b) No. of Strands/ Lay Direction	Please note that No. of Strands/ Lay Direction is a in-process related activities. At Raw material stage, same is not applicable.	Please refer Corrigendum No. 2
181		A. 1(c)	Copper Conductor / Rod	Pdf Page 202 /306	c) DC Resistance	DC resistance is applicable on finished conductor and same is not applicable during raw material stage	Please refer Corrigendum No. 2
182		A. 1(d)	Copper Conductor / Rod	Pdf Page 202 /306	d) Resistivity	Please note that Instead of resistivity, Conductivity is applicable.	Please refer Corrigendum No. 2
183		A.3(e)	Copper Tap	Pdf Page 203 /306	e) ID / OD of Coil	Please note that ID/OD of Coil is not applicable.	Please refer Corrigendum No. 2
184		5(a-f) & 6(a-c)	XLPE Compound Semi-conducting compound	Pdf Page 203 /306	5. XLPE Compound 6.Semi Conducting Compound	Manufacture's certificate as received shall be shared. Kindly accept.	Please adhere to bid conditions
185		7	Accessories	Pdf Page 204 /306	7.Accessories (as applicable)	Please note that MQAP is for cable testing. Hence these accessories are not applicable.	Please adhere to bid conditions
186	1.1 kV XLPE Cable	A. 2(b)	Copper Conductor/ Rod	Pdf Page 206 /306	b) No. of Strands & Lay Direction	Please note that No. of Strands/ Lay Direction is a in-process related activities. At Raw material stage, same is not applicable.	Please refer Corrigendum No. 2
187		A. 2(c)	Copper Conductor/ Rod	Pdf Page 206 /306	c) DC Resistance	DC resistance is applicable on finished conductor and same is not applicable during raw material stage	Please refer Corrigendum No. 2
188		A. 2(d)	Copper Conductor/ Rod	Pdf Page 206 /306	d) Resistivity	Please note that Instead of resistivity, Conductivity is applicable.	Please refer Corrigendum No. 2
189	Cabling System- Control and Instrumentation	A. 1(b)	Copper Conductor / Rod	Pdf Page 209 /306	b) No. of Strands/ Lay Direction	Please note that No. of Strands/ Lay Direction is a in-process related activities. At Raw material stage, same is not applicable.	Please refer Corrigendum No. 2
190		A. 1(c)	Copper Conductor / Rod	Pdf Page 209 /306	c) DC Resistance	DC resistance is applicable on finished conductor and same is not applicable during raw material stage	Please refer Corrigendum No. 2
191		A. 1(d)	Copper Conductor / Rod	Pdf Page 209 /306	d) Resistivity	Please note that Instead of resistivity, Conductivity is applicable.	Please refer Corrigendum No. 2
192		D(g)	Acceptance Tests	Pdf Page 210 /306	g) Hot Set Test for Insulation	Please note that Hot Set Test for Insulation is applicable for XLPE insulation. Same is not applicable for PVC.	Please adhere to bid conditions
193	MODEL QUALITY ASSURANCE PLAN (QAP) FOR-Cable Tray and Cable Junction Box	A-1(c)	(MS Sheet/Channel /Angle)	Pdf Page 211 /306	c) Surface Finish	Please note that Surface Finish test is not applicable . Same doesn't appears on manufactuer's TC	Please refer Corrigendum No. 2
194		A-2(a)	Fasteners and Hardwares	Pdf Page 211 /306	b) Quality of Zinc Deposit over Threaded Portion	Quality of Zinc deposit is not applicable on threaded portion. Instead mass of Zinc coating is applicable	Please adhere to bid conditions

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195		B(1-3)	In Process Inspection	Pdf Page 211 /306	In Process Inspection	Please note that supplier doesn't share in-process report. Therefore, TC is not feasible. It is to be further noted that all the galvanizing related tests are already present in final inspection. Kindly accept.	Please adhere to bid conditions
196		C.2	Final Inspection	Pdf Page 212 /306	2) Load Capacity	Please note that Load Capacity test will be applicable on width 300 mm and above.	Please adhere to bid conditions
197	MODEL QUALITY ASSURANCE PLAN (QAP) FOR-MV SWITCHGEAR & AUXILIARY	A.1(a)	Steel Sheel	Pdf Page 214 /306	a) Material Testing	Pl. note that Instead of material testing of sheet, Mechanical & Chemical Properties of sheet is applicable. Kindly accept.	Please adhere to bid conditions
198		A.3(a-d)	FRP Sheets	Pdf Page 214 /306	FRP Sheet	Pl. note that FRP Sheet (Fibre Re-inforced Plastic) is a non critical item. Supplier souced this sheet from the open market where they doesn't get certificate for the same. Hence TC is not feasible.	Please refer Corrigendum No. 2
199		A. 5-7	5.Protective Relays (Over current & Earthault, Under voltage etc.) 6.KWH Meter 7. Indicating Instrument 10. HRC fuse 14. Switches/ Control Switches 16. Space Heater 18. Indicating Lamp, Push Button, Contact Block	Pdf Page 214-216/306	5. Protective Relays (Over current & Earthault, Under voltage etc.) 6.KWH Meter 7. Indicating Instrument 10. HRC fuse 14. Switches/ Control Switches 16. Space Heater 18. Indicating Lamp, Push Button, Contact Block	Please note that TC/ Certificate of compliance shall be provided. Kindly accept.	Please refer Corrigendum No. 2
200		A-8	MCCB, MCB & Contactor	Pdf Page 215 /306	MCCB, MCB 8 Contactors	Please note that MCCB, MCB & Contactors will be sourced from authorized traders Therefore, TCs for these components are not feasible.	Please refer Corrigendum No. 2
201		A-9, 12 & 13	9. Motor 12. Vacuum Interrupter 13. Spring	Pdf Page 215-216/306	9. Motor 12. Vacuum Interrupter 13. Spring	Please note these components are an integral part of Vacuum circuit breaker. No separate test certificate is feasible. Kindly accept.	Please refer Corrigendum No. 2
202		A-15	15. Isolating Contacts	Pdf Page 216 /306	15. Isolating Contacts	This is not applicable as per design	Please adhere to bid conditions
203	MODEL QUALITY ASSURANCE PLAN (QAP) FOR-Station Auxiliary transformer (SAT)- Dry type	A.4(a,b)	Fibre Glass Sheet/ Insulation barriers	Pdf Page 216 /306	Fibre Glass Sheet	This is not applicable as per design	Please adhere to bid conditions,
204		B.3(a&d)	Winding Temperature Indicator	Pdf Page 220 /306	Winding Temperature Indicator a)Dial Size, Range , LC d) Alarm & Trip Operation	a) Please note that Instead of Dial Size, Model is applicable. List count (LC) doesn't appear on manufature's TC. b) Alarm & Trip Operation operation also doesn't appear on manufature's TC	Please adhere to bid conditions
205		B.4	PTC Thermistor with alarm and trip device	Pdf Page 220 /306	PTC Thermistor with alarm and trip device	This is not applicable as per drawing.	Please adhere to bid conditions
206		B.5	Off Circuit Tap Changer	Pdf Page 220 /306	Off Circuit Tap Changer	Please note that the taps are changed through tap link made of small copper strip by the transformer manufacturer. No certificate comes for this item	Please adhere to bid conditions
207		C1(a,b)	Type Tests	Pdf Page 216 /306	<u>Type Test</u> a) Temperature Rise Test b) Lightning Impulse Test	VHN propose to accept equivalent / higher rating type test in place of witnessing the test. Kindly accept.	Please adhere to bid conditions
208	MODEL QUALITY ASSURANCE PLAN (MQAP) FOR DG SET	2(a,b) 5(a-d)	Electronic qoverner AVR (Automatic Voltage Regulator)	Pdf Page 224 /306	Electronic qoverner AVR (Automatic Voltage Regulator)	Please note that Electronic governer and AVR are an integral part of Engine. No separate manufacture's certificate comes for this item. Kindly accept	Please adhere to bid conditions.
209		7(a,b)	Battery Charger	Pdf Page 224 /306	Battery Charger	Please note that Battery Charger is in-built part of AMF Panel. No separate manufacture's certificate comes for this item.	Please adhere to bid conditions.
210		8 (a)-(d)	Electrical Equipments	Pdf Page 225 /306	• Circuit Breaker & Contactors, Neutral Earthing • Numeric Type Protection Relays (Reverse power, Differential Protection, Restricted Earth Fault, Under voltage, Under frequency, Very Low Fuel Level and Fail to start (Over crank) situation Instantaneous & IDMT overcurrent etc.) •CT, PT Meters (Ammeters, Voltmeter, Wattmeter, Energy Meter, Running Hour Meter, Frequency Meter, Alarms & Annunciation system etc.) •Push Buttons, Alarms & Annunciation system etc • Control & Selector Switch	Kindly note that all these item would be of make and same will be either sourced from authorized trader or open market. Hence Manufactuer's TC is not feasible. Kindly accept	Please adhere to bid conditions.

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
211		9 (a)	Accoustic Enclosure,	Pdf Page 225 /306	Quality of Sheet and insulation material	Kindly note that Quality of Sheet we have considered dimension check & for Insulation Material, no certificates comes as same will be procured from open market. Kindly accept.	Please adhere to bid conditions.
212		11 (ii)	Final Inspection on DG Set	Pdf Page 226 /306	100% load test for 10 hr	Please note that due to common test bed (Production & Testing) limitation, Testing of DG set for 10 Hrs long duration is not feasible at Works. Therefore VHN proposes to accept Load test duration for 04 Hrs. Kindly accept.	Please adhere to bid conditions.
213		13	Monorail Hoist	Pdf Page 226 /306	Monorail Hoist Arrangement alongwith Chain pulley biock with associated accessories	This is not applicable for DG set.	Please adhere to bid conditions.
214	MODEL QUALITY ASSURANCE PLAN (QAP) FOR LV SWITCHGEAR SYSTEM AND AUXILIARY TRANSFORMERS	A1(a)	Steel Sheets	Pdf Page 228 /306	a) Dimension(Size of Sheet, Uniformity of Thickness, Surface Finish)	a) Pl. note that manufactuer's TC doesn't specify test like Uniformity of Thickness, Surface Finish. Hence TC for the same is not feasible.	Please adhere to bid conditions
215		A(4-6,8,10-11)	4. MCCB / MCB 5. Power & Auxiliary Contactor 6. Overload Relay 8.Timers 10.Space Heater 11.witches/ Control Switches	Pdf Page 228-230 /306	4. MCCB / MCB 5. Power & Auxiliary Contactor 6. Overload Relay 8.Timers 10.Space Heater 11.witches/ Control Switches	Please note that these are trader based items to be procured from authorizied traders. Therefore, TC for such item is not feasible. We will submit COC against these items. Kindly accept.	Please refer Corrigendum No. 2
216	MODEL QUALITY ASSURANCE PLAN (QAP) FORLV Bus Duct	1.3	Epoxy Insulator	Pdf Page 231 /306	d) Bending Resistance Test e) Thermal Shock tes	Kindly note that These tests doesn't appear on manufature's TC. Hence TC for these tests are not feasible. .	Please adhere to bid conditions
217	MODEL QUALITY ASSURANCE PLAN (QAP) FOR Unit Auxiliary transformer (UAT), Station Service Transformer (SST), Distribution Transformer (DT) , Auxiliary Transformer (AT) - Dry type	A.4(a,b)	Fibre Glass Sheet/ Insulation barriers	Pdf Page 235 /306	Fibre Glass Sheet	This is not applicable as per design	Please adhere to bid conditions
218		B.3(a&d)	Winding Temperature Indicator	Pdf Page 236 /306	Winding Temperature Indicator a)Dial Size, Range , LC d) Alarm & Trip Operation	a) Please note that Instead of Dial Size, Model is applicable. List count (LC) doesn't appear on manufature's TC. b) Alarm & Trip Operation operation also doesn't appear on manufature's TC	Please adhere to bid conditions
219		B.4	PTC Thermistor with alarm and trip device	Pdf Page 236 /306	PTC Thermistor with alarm and trip device	This is not applicable as per drawing.	Please adhere to bid conditions
220		B.5	Off Circuit Tap Changer	Pdf Page 236 /306	Off Circuit Tap Changer	Please note that the taps are changed through tap link made of small copper strip by the transformer manufacturer. No certificate comes for this item	Please adhere to bid conditions
221		C1(a,b)	Type Tests	Pdf Page 237 /306	Type Test a) Temperature Rise Test b) Lightning Impulse Test	VHN propose to accept equivalent / higher rating type test in place of witnessing the test. Kindly accept.	Please adhere to bid conditions.
222	MODEL QUALITY ASSURANCE PLAN (QAP) FOR ILLUMINATION SYSTEM	A.I. 1A.I. 4□	Raw Material	Pdf Page 240 /306	1. Aluminium Casting 2. LED Driver	Please note that Aluminium casting & LED Driver are an integral part of luminaries. Complete luminaries a will be sourced from authorized traders. No Manufacture's provide individual components certificates. Hence TC is not feasible Kindly accept.	Please refer Corrigendum No. 2
223		A.I.3	Raw Material	Pdf Page 240 /306	Paint	Paint is not applicable.	Please refer Corrigendum No. 2
224		A.II.2(a)	Raw Material	Pdf Page 241 /306	Dimension Conformity	Please note that in manufacture's TC, Dimension Conformity doesn't appears. Hence TC is not feasible.	Please adhere to bid conditions
225		A.II.3	Acceptance Tests	Pdf Page 241 /306	3. Acceptance Test (a-e)	Please note that Luminaries will be sourced from authorised trader. Therefore, Only Make & Type will be feasible. Rest is not feasible.	Please adhere to bid conditions
226		B. 5	Raw Materials & Bought Out Items	Pdf Page 243 /306	MCCB, MCB, ELCB ,Power & Auxillary Contractor, Timer, Receptacle , Switches & Control Switches, Transducer, Current Transformer, Potential Transformer, Electrical Meters(Ammeter & Voltmeter), Indicating Lamp, TB, Fuses, Space Heater, Thermometer (Thermostat)	Please note that Manufacture's TC as received from component manufacturers like Current Transformer, Potential Transformer, Electrical Meters (Ammeter & Voltmeter) shall be provided. Certificate of Compliance (COC) for the rest of the components. Annunciater, Transducer and Energy Meters are not as per design. Hence, same will not be applicable.	Please refer Corrigendum No. 2

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
227		C.2(a)	Aluminium Ladder& Adjustable Platform	Pdf Page 244 /306	a) Raw Material	Please note that Ladder is a ready made item and same will be souced either from open market or traders. Therefore, Raw material certificate is not feasible.	Please refer Corrigendum No. 2
228		C.2(c)	Aluminium Ladder& Adjustable Plateform	Pdf Page 244 /306	c) Routine Test	Routine Test is not applicable.	Please refer Corrigendum No. 2
229		C.3 (a)	Junction Box, Switchboard & Receptacle	Pdf Page 244 /306	a) Raw Material c) Routine Test	a) Please note that Junction Box, Switch board & Receptacle is a ready made item and same will be souced either from open market or traders. Therefore, Raw material certificate for these small items c) Routine test is not applicable.	Please refer Corrigendum No. 2
230		5(b)	Lighting/ Distribution Transformer	Pdf Page 244 /306	Routine Test.	Being a small transformer, we would request you to accept manufacture's internal certificate.	Please adhere to bid conditions
231		6(a)	Inverter, UPS & Battery	Pdf Page 244 /306	a) Raw Material	Please note that raw material certificate for this small rating standard item is not feasible. Kindly accept.	Please refer Corrigendum No. 2
232		6(b)	Inverter, UPS & Battery	Pdf Page 244 /306	Routine Test.	Manufacture's certificate as received shall be shared instead witnessing the test. Kindly accept.	Please adhere to bid conditions
233	MODEL QUALITY ASSURANCE PLAN (QAP) FOR COMMUNICATION SYSTEM	A.2(b)-(ii)	Type Test Routine Test	Pdf Page 246 /306	ii) Type Test ii) Routine Test	Kindly note that these are trader based items. Hence , Type & Routine test certificate iare not feasible. Kindly accept.	Please adhere to bid conditions
234		A.2(c)-(ii)	Central paging control & amplifier rack	Pdf Page 246 /306	Functional Test & Mounting Arrangements	Test is not feasible at Trader place. Same will be demonstrated at site during commissioning.	Please adhere to bid conditions
235		A.6(i)	Junction Box	Pdf Page 247 /306	Make, Model & Rating	Junction Box has No make, Model & Rating. It is to be fabricated item as per drawing. Hence same is not applicable.	Please refer Corrigendum No. 2
236		C.4(i)	Conference Table, Chairs	Pdf Page 249 /306	Make, Model & Specification	Please note that in the case of Conference Table & Chair, Make and Specification is not applicable as we don't have any name plate. Only model is applicable.	Please adhere to bid conditions
237		D.1-(i)-(iii)	Components of Communication System	Pdf Page 250 /306	1) Type Test	Please note that product will be proven design and same will be procured from reputed trader. Therefore, Type test is not feasible as no manufacture's shares such type test to any traders..	Please adhere to bid conditions
238		D.2-(i)-(ii)	Routine Tes	Pdf Page 250 /306	i) Di-electric Test ii) Test on Protective Earthing Connections	This is an electronic device and comes in completely assembled condition after testing. Therefore these tests are not feasible.	Please refer Corrigendum No. 2
239	MODEL QUALITY ASSURANCE PLAN (QAP) FOR Grounding System	2(iii)	Final Inspection	Pdf Page 274 /306	Electrical Resistance of Material	This test is not applicable on MS Flat / Rod.	Please adhere to bid conditions

Sr. No.	Volume	Clause no	Clause name	Page No	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
240	Volume-III B	5.3.1	Rating	5-3	13. Maximum permissible temperatures under maximum Power (155.3 MVA) with ambient temperature 40°C and cooling water inlet temperature 30°C: A) Stator winding = 105°C B) Rotor winding = 105°C C) Thrust bearing pads - 75°C D) Guide bearing segments = 65°C	As per IEC60034-33:2022 clause no. 6.1 Temperature rise up to class B (Thermal class-130) shall be: For Stator= 85°C (125°C absolute) For Rotor= 90°C (130°C absolute) Based on reference of recent executed projects: Absolute temperature will be following: Thrust bearing metal temp : 80°C Guide bearing metal temp : 70°C Kindly accept.	Please refer Corrigendum No. 2
241	Volume-III B	5.4.2	Guaranteed efficiency	5-5	The guaranteed weighted average efficiency, at rated voltage and frequency as determined from the following formula, shall not be less than 98.5 percent.	Considering the weighing factors, the expected WAE is quite high, we propose to make it 98%. kindly accept.	Kindly adhere to technical specification.
242	Volume-III B	5.5.4	Housing and support	5-8	The top cover shall be designed for a minimum live load of 1000 kg/m^2 having removable formed steel panels.	As a standard practice, the live load shall be 250 kg/m^2. Kindly accept.	Kindly adhere to technical specification.
243	Volume-III B	5.5.8	Main shaft and coupling	5-10	The contractor shall calculate the critical speed of the combined turbine and generator rotating parts and first critical speed shall be at least 25% above the runaway speed.	As per global practice in hydro, first critical speed can be at least 20% above the maximum runaway speed. Also as per IEC 60034-33 standard, it is 10%, VH recommend to acceptance value is 20%, Kindly accept.	Kindly adhere to technical specification.

No.	Volume	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
244	GCC- Vol IIA	1.1	Definition “Effective Date” means the date from which the time for completion shall be determined as stated in Article 3 (Effective Date for Determining Time for Completion) of the Contract Agreement.	For Clarity ,we request M/s NHPC to kindly incorporate the following definitions of effective date and commencement date. 1. Effective date shall be the date of issuance of Letter of Award to the contractor 2. Commencement date shall be the latest of the following events. a). Date of signing of the contract agreement. b). Receipt of Interest free advance in line with the payment terms. c). Opening of confirmed and irrevocable letter of credit (LC) within 30 days from the Effective date of Contract. Please accept	Bid specifications are quite clear in this regard. Please adhere to bid specifications.
245	GCC- Vol IIA	13.2.1 (i)	Advance payment, maximum of 10% of Contract Price (for supply portion only) may be released. Such advance payment shall be interest bearing which shall be at Long term (3 years) MCLR of State Bank of India plus margin of 150 basis points above MCLR as on 28 days prior to Bid Submission date calculated on daily basis.	We request NHPC to modify this clause as under:- Advance payment, maximum of 10% of Contract Price (for supply portion only) may be released. Such advance payment shall be released against submission of interest bearing bank guarantee which shall be at Long term (3 years) MCLR of State Bank of India plus margin of 100 basis points above MCLR as on 28 days prior to Bid Submission date calculated on daily basis. Please note, similar provision is provided by NEEPCO which is 100% subsidiary of NTPC. Kindly accept our request.	Bid specifications are quite clear in this regard. Please adhere to bid specifications.
246	GCC- Vol IIA	13.3.3	The security shall be reduced pro rata to the Contract Price of a part of the Facilities for which a separate time for Completion is provided, twenty seven (27) months after Operational Acceptance of the Facilities	The provision under the clause is not clear. Request you to please elaborate.	Please adhere to bid specifications.
247	GCC- Vol IIA	26.2	Liquidated Damages	We understand that the LDs shall be applicable on Contract Price less the taxes and duties. Please Confirm.	Please adhere to bid specifications.
248	GCC- Vol IIA	27.2	Defects Liability The Defect Liability Period shall be thirty six (36) months from the date of issue of Taking-Over Certificate of the generating unit which is commissioned first or twenty four (24) months from the date of issue of Taking-Over Certificate of the generating unit which is commissioned last whichever happens earlier	The Defect Liability Period shall be twenty four (24) months from the date of issue of Operational Acceptance/COD of the generating unit which is commissioned last or thirty six (36) months from issuance of Completion Certificate of the 1st generating unit which has reached Completion, whichever occurs first. Please accept.	Please adhere to bid specifications.

No.	Volume	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
249	GCC- Vol IIA	27.8	Defects Liability Upon correction of the defects in the Facilities or any part thereof by repair/replacement, such repair/replacement shall have the Defect Liability Period extended by a period of twenty-four (24) months from the time such replacement/repair of the Facilities or any part thereof or up to forty eight (48) months from the date of Operational Acceptance of the Facilities (or any part thereof) whichever is earlier. 27.8.1 At the end of the Defect Liability Period, the Contractor's liability ceases except for latent defects. The Contractor's liability for latent defects warranty shall be limited to a period of five (5) years from the end of Defect Liability Period.	We understand that the overall Defects Liability Period including repair and replacement if any, shall not exceed 48 months from the date of Operational Acceptance of the Facilities (or part thereof). Please confirm. Also please reduce the latent defects period to two (02) years.	Please adhere to bid specifications.
250	GCC- Vol IIA	34	Insurance	We Understand that the insurance requirement shall be in line with the latest IRDA guidelines . Please Confirm.	Bid specifications are quite clear in this regard. Please adhere to bid specifications.
251	GCC- Vol IIA	37.10 €	Force Majeure Acts of God such as earthquake (above magnitude of 7 of Ritcher Scale), any natural calamity as notified by Government of India v.i.z. spread of virus (corona virus in instant case) beyond human control, lightening, unprecedented floods.	Kindly remove the text within brackets i.e. "*above magnitude of 7 of Ritcher Scale* "	Please adhere to bid specifications.
252	GCC- Vol IIA	Annex-A to GCC	Charges towards extended warranty shall be calculated up to 2% of composite contract price per annum on prorata basis.	The extension of warranty is generally charged at 4% or even higher by the sub-contractors. Therefore request you to kindly increase the percentage value for extension of warranty. Please Confirm.	Please adhere to bid specifications.
253	GCC- Vol IIA	Annex A to GCC	Valuation of Idling Time Cost Claims	The Annex A does not cover the valuation of the Idling Time for the Contractor's own employees for design, project management and other functions involved in the project. Request you to include a provision to cater the valuation of the idling time for the same. Please Confirm.	Please adhere to bid specifications.
254	SCC- Vol IIB	4	In the event that the Contractor is unable to proceed with the Pre-commissioning of the Facilities pursuant to Sub Clause 24.3, or with the Guarantee Test pursuant to Sub Clause 25.2, for reasons attributable to the Employer either on account of non-availability of other facilities under the responsibilities of other contractor(s),	We understand that the said Clause shall not be applicable in case of delay by other Sub Contractors employed by the employer . Please Confirm.	Please adhere to bid specifications.
255	SCC- Vol IIB	4.2	When the Contractor is notified by the Engineer In-Charge, that he will be unable to proceed with the activities and obligations pursuant to above Sub-Clause 4.1, the Contractor shall be entitled to the following:	We request NHPC to include additional condition: "Defect Liability Period shall stand reduced to the extent of delay in start of pre-commissioning or guarantee test." Please Confirm.	Please adhere to bid specifications.

No.	Volume	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
256	SCC- Vol IIB	6.7.1 (b) & (c)	However, if such spare parts are put to use after 24 months of the delivery at Site then the guarantee of such spares will stand valid till the expiry of 36 months from the scheduled date of the completion of Commissioning of equipment/plant of trouble free operation after such spares are put in service.	The warranty period of the same equipment has to be same and cannot be different. We also understand that (b) & (c) are applicable only for Recommended Spares. Please confirm.	Bid specifications are quite clear in this regard. Please adhere to bid specifications.
257	SCC- Vol IIB	18	GCC Clause 27.7 :- The Contractor shall depute, initially, for first 50% of the time of Defect Liability Period, at site one coordinator and sufficient number of Supervisors/skilled technicians, to coordinate and repair, modify and replace the faulty system in Defect Liability Period. The Engineer-in-charge shall approve the list of above mentioned manpower. The above skilled manpower shall take up all necessary steps for repair, modification or replacement of defects, deficiencies or damages	We Understand the said deputation shall be effective in case of any defect occurs/noticed during defect liability period. Please Confirm	Bid specifications are quite clear in this regard. Please adhere to bid specifications.
258	SCC- Vol IIB	22	Penalty on account of non-attendance of fault in Control, Monitoring and SCADA System	We request NHPC to mentioned the correct clause no under this clause , it should be clause 14.4.1 instead of 15.4.1 . Please correct the same.	Please refer Corrigendum No.02
259	Appendix 1		Two and half percent (2.5%) of the total EXW amount (as per Price Schedule No.1) after submission and approval of the balance data for Civil Design and completion of major design works of Turbine & Generator and approval of design memorandum of all the packages and placement of POs for at least 50% BOP items/ systems & submission of drawings (as required) and on expiry of 14 months reckoned from the date of issue of Notification of Award or reckoned from the date of release of initial interest bearing advance, if applicable.	Please specify very clearly, what is meant by "placement of POs …"? Is this placement with respect to quantity or price?	Please adhere to bid specifications.
260	Appendix 1	3.3	Except as above, other payments shall be arranged through irrevocable Letter of Credit opened in a designated Bank (Issuing bank), which shall make payments to the Contractor upon presentation of documents against conditions specified in the Letter of Credit to the Negotiation bank of the Contractor. The contractor shall provide quarterly cash flow statement as per payment schedule two months in advance to the Engineer-in- charge to facilitate opening/extension of L/C in time. The amount of L/C shall be equivalent to the projected quarterly cash flow of the Contractor. The L/C for the said amount shall be opened by the Employer thirty (30) days prior to the scheduled date of 1st payment under the Contract against the L/C and shall be maintained thereafter by extending the same on quarterly basis as per the projected cash flow of the Contractor. The conditions of Letter of Credit shall be as below:	We request NHPC to open the L/C within 30 days from the Effective date of Contract.	Please adhere to bid specifications.
261	Appendix 1	3.3	Transhipment - Not Allowed/ Allowed in exceptional circumstances only(Applicable for despatch of materials only)	Kindly allow the provisions for Transshipment We understand that all the LC charges including establishment and confirmation shall be borne by the Employer. Please accept.	Please adhere to bid specifications.

No.	Volume	Clause No.	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
262	Appendix 2		The total adjustment (plus or minus) shall be subject to a ceiling of 25% of the Contract Price during contractual completion period	We request NHPC to kindly remove the ceiling limit on total adjustment of price during contractual completion period as commodities prices are fluctuating a lot in recent times. Please Confirm.	Please adhere to bid specifications.
263	Appendix 3	(a)	Cargo Insurance i) For Domestic Bidder, Contract Price of First Contract + Contract Price of Second Contract excluding installation charges + 25% (to cover Price Variation and taxes & duties etc.) of First Contract Price.	We request NHPC to kindly this clause as under:- i) For Domestic Bidder, Contract Price of First Contract + Contract Price of Second Contract excluding installation charges + ~~25~~ 10% (to cover Price Variation and taxes & duties etc.) of First Contract Price	Please adhere to bid specifications.
264	Appendix 3	(b)	Erection All Risk- The policy shall be extended to cover Work Stoppages clause and Intermittent Testing clause	Please appreciate EAR Insurance shall be provided as per IRDA Regulations. Please confirm.	Please refer Corrigendum No.02
265	Appendix 3	(c)	Third Party Liability Insurance 2,000,000 USD per occurrence, unlimited no. of occurrence	The amount 2,000,000 USD (i.e. INR 17,23,20,000) per occurrence is on the higher side. Kindly consider reducing the limit. Furthermore kindly limit the amount per occurrence and in aggregate with unlimited no. of occurrence. Kindly appreciate an aggregate cap is required as per IRDA requirement as insurance cover with unlimited liability is not available. Please Confirm.	Please adhere to bid specifications.
266	Appendix 3		(b) Erection All Risks Insurance (AOG)	We understand Act of God(AOG) is excluded from Contractor scope and shall be in NHPC scope. Please Confirm.	Please adhere to bid specifications.
267	Appendix 8	4.3	Subject to para. 4.2 above, the Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantees shall not exceed twenty five percent (25 %) of the Contract price	Kindly limit the cap on performance LD up to 15% of the Contract Price less taxes and duties. Please Confirm.	Please adhere to bid specifications.
268	Form 14		Parent Company Agreement	The liability of the Parent under the Parent/ Holding Agreement is not mentioned. We understand the aggregate liability of the Parent/ Holding company and the Contractor under the Parent/ Holding Agreement shall be read in conjunction with the GCC Clause no. 30. Please confirm. This has been clarified by NHPC in earlier projects also.	Bid specifications are quite clear in this regard. Please adhere to bid specifications.
269	Vol IIIB-PTS, Generator and Turbine	2.4.4 & 5.4.3	Liquidated damages for shortfall in output and efficiency	The LD rates for shortfall in Weighted average efficiency and the output is very high. Request you to kindly re-evaluate and reduce the LD values.	Please adhere to bid specifications.
270	Volume V (Forms & Procedures)	Attachment 2	Power Of Attorney	Kindly allow us to provide our General Power of Attorney which the Board of Management has allocated to the authorized signatories in place of the Power of Attorney as prescribed in Attachment 2.	Bid specifications are quite clear in this regard. Please adhere to bid specifications.
271	General		BOCW (Building and other construction workers) Cess	We understand that BOCW cess shall be applicable only on Service portion prices. Kindly confirm.	Please adhere to bid specifications.

INFORMATIVE REPLIES

PART-E

Sr. No.	Volume	Page no	Clause no	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
1.	Volume-1 Information For Bidder (IFB) / Clause 4 Volume-4 Tender Drawings		Clause 4	Salient Features – Surge Shaft and Surge gallery for downstream water conductor	Kindly provide below details which is not available in given clause and drawings. - Surge shaft orifice diameter and orifice loss coefficients. Also provide cross section drawing showing these details. - Downstream Surge gallery cross-section drawing.	kindly adhere to tender specifications.
2.	Volume-IV-Tender Drawings			Tender Drawings	Given tender drawings are not readable. Kindly provide drawings with clearly visible dimensions.	Please refer Corrigendum No. 2
3.	Volume-3B/PTS 2.2.2 (v) /Page2-4	Page 2-4	PTS 2.2.2 (v)	Hydraulic Conditions – Head Loss	Tender clause specifies Maximum Head Loss as 23.0m at rated discharge. Kindly provide separate head loss values for tunnels upstream of powerhouse and downstream of powerhouse to perform transient analysis.	kindly adhere to tender specifications.
4.	Volume-3B/PTS 2.2.3.4 /Page2-5	Page 2-5	PTS 2.2.3.4	Noise	It is given that the maximum noise level at any place at 1.0 m (One meter) distance shall not exceed 90 dB. We understood that at turbine floor 90dB shall be at 1.0m distance from turbine pit. Kindly confirm.	Tender Provisions are clear
5.	Volume-3B/PTS 2.5.6.4 /Page2-27	Page 2-27	PTS 2.5.6.4	Shaft Seals - cooling	Tender specifies water for shaft sealing shall be drawn from the respective draft tube/ tail pool by pumps and shall be suitably cleaned and filtered before supplying to the shaft seal at a suitable pressure as per Schematic flow diagram no. NH/DEM/ URI I STG II /CW/01. However, in a drawing, the proposed arrangement is not shown. Kindly confirm that shaft seal water supply from main cooling water system is also acceptable.	Please refer Corrigendum No. 2
6.	Volume-3B/ PTS Cl 2.5.9 / Page 2-34	Page 2-34	PTS Cl 2.5.9	Hard Coating	Tender asks for Hard coating of below parts for wicket gate… i) Wicket Gate a) Lower trunnion complete b) Upper trunnion – at least 200mm above the guide vane collar Wicket gate trunnion requires high surface finish of ~0.8 Ra. Further wicket gate trunnions shall have rotary seals and self-lubricated bearings which requires high surface finish for proper sealing at collar and equal distribution of load at bearing area. Hard coating shall have surface roughness of ~ 6 Ra which will erode seals and bearings. Further, suitable trunnion sealing is provided to arrest the flow of silt laden water towards wicket gate bush. Hence, hard coating on wicket gate lower and upper trunnion is not recommended. Kindly delete the requirement.	Tender Provisions are clear
7.	Volume-3B/ PTS Cl 2.9.1 (ix) & (x) / Page 2-39	Page 2-39	PTS Cl 2.9.1 (ix) & (x)	Special tools - Hydraulic torque tensioners	We propose to supply (2) two sets of hydraulic torque tensioner attachments i.e. (1) one attachment for runner/turbine shaft and (1) one attachment for turbine shaft/generator shaft, operated by a common power pack for both. Kindly confirm.	Tender Provisions are clear

Sr. No.	Volume	Page no	Clause no	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
8.	Volume-3B/ PTS Cl 4.5.3 / Page 4-5	Page 4-5	PTS Cl 4.5.3	Material selection and standards	ASTM A537 class-1 material is specified for valve body, valve rotor and connection sleeves. Kindly allow bidder to offer ASTM A516 Gr70 also in line with Turbine and Auxiliaries PTS Clause 2.5.3.	Tender Provisions are clear
9.	Volume-3B/ PTS Cl 24.2.2 / Page 24-3	Page 24-3	PTS Cl 24.2.2	Twin cooling water circuit	Kindly provide location of a makeup water tank and fire water tank. Also confirm that a makeup water tank shall be of other contractor's scope of supply and not a part of EM supplier scope of supply.	Tender Provisions are clear
10.	Volume-3B/ PTS Cl 24.3.1 / Page 24-5	Page 24-5	PTS Cl 24.3.1	Safety margin on flow and head	Two different requirements of a minimum safety margin of flow are specified in given clause. - margin of 15% over and above the water requirement at maximum continuous rating (MCR) - margin of 10% over and above the duty point. i.e desired flow Kindly confirm the minimum safety margin to be considered for flow.	Please refer Corrigendum No. 2
11.	Volume-3B/ PTS Cl 24.3.1 / Page 24-5	Page 24-5	PTS Cl 24.3.1	Fluid velocity in the pipes	Tender requirement of 4m/s fluid (water) velocity in pipe is on higher side. As per general practice, maximum water velocity through pipes shall not exceed 3m/s. Kindly confirm.	kindly adhere to tender specifications.
12.	Volume-3B/ PTS Cl 25.2.1.5 / Page 25-3 Drawing: NH/DEM/URI-ISTG-II /DD/01	Page 25-3	PTS Cl 25.2.1.5	Flood Dewatering Sump/ Pump	The tender clause specifies "water accumulated in the sump/floor will be pumped out of the power house to DT gate downstream". However, in given schematic drawing, flood dewatering pumps shares a same header with drainage pumps wherein water shall be discharged to river via MAT. Kindly confirm discharge location of flood dewatering pumps header.	Please refer Corrigendum No. 2 water shall be discharged to river via MAT.
13.	Volume-3B/ PTS Cl 25.2.1.5 / Page 25-4 Drawing: NH/DEM/URI-ISTG-II /DD/01	Page 25-4	PTS Cl 25.2.1.5	Flood Dewatering Sump/ Pump	The tender clause specifies "All the dewatering submersible pumps shall feed water into a common discharge header and shall finally deliver through a outlet line with outside flap valve to TRT (at approx. EL 1267M) via DT gate hall". However, in given schematic drawing, common header shows dewatering water discharged to DT gate Hall. Kindly confirm discharge location of dewatering pumps header.	Tender Provisions are clear
14.	Volume-3B/ PTS Cl 25.2.1.6 / Page 25-4	Page 25-4	PTS Cl 25.2.1.6	25.2.1.6 Civil areas/ works Additional area drainage	Tender asks for drainage of additional areas as below. - Main Access tunnel (MAT) - MAT and Adit to Powerhouse cavern crown - Adit cum Cable Gallery - Cable cum Escape Tunnel (02 Nos) - Adit to lower Penstock Erection gallery Kindly provide above tunnels drawings with tentative location of drainage sumps. Kindly also specify quantity of pumps to be considered and location of discharge header from these sumps to workout length of piping and pumps head calculation. This information is necessary to workout drainage system.	kindly refer lay out drawings and further details shall be finalized during detail engineering
15.	Volume-3B/ PTS Cl 26.2.1		PTS Cl 26.2.1	Layout and General Arrangement	HVAC flow diagram no. NH/DEM/URI-I STG-II/ AC /01 as mentioned in given clause is not given in tender drawings. Kindly provide a HVAC diagram.	Please refer Corrigendum No. 2

Sr. No.	Volume	Page no	Clause no	Tender Provision	Pre-bid Query/Question	NHPC Reply/ Clarification
16.	Volume-3B/ PTS Cl 28.3.2 / Page 28-3	Page 28-3	PTS Cl 28.3.2	Capacity of compressor	Tender specifies two different capacities for LP compressors as below. - The minimum rating of each LP air compressor shall be 180 m3/hr (FAD). - The compressor shall … be at least ten (10) cfm (FAD) at seven (7) bars. Kindly confirm minimum capacity of LP compressor.	Capacities are mentioned for two different LP compressors for two different locations. Tender Provisions are clear
17.	Vol-3B (Particular Technical Specifications (PTS) 6.2.1 Layout & General Arrangement			The control / programming of the system is to be done through MMI located on the DVR.	Programming of the system shall be do through Laptop/PC	Tender Provisions are clear
18.	Vol-3B (Particular Technical Specifications (PTS) 6.5.7 Control cubicle			viii) Channel output balance meter of automatic and manual regulating channels.	It is software features not a in hardwire. Balancing of Auto and Manual channel shall be due from software logic.	Tender Provisions are clear
19.	Vol-3C Technical Data Sheets (TDS) 6. MODEL QUALITY ASSURANCE PLAN (QAP) FOR EXCITATION SYSTEM & EXCITATION TRANSFORMER			Test on Rectifier & Controller h) Burn in Test QUANTUM OF CHECKS 100%	QUANTUM OF CHECKS We request to accept certificate applied in similar unit in the past.	Please adhere to bid specifications. (Burn in Test has already been kept under TC category)
20.	Vol-3C Technical Data Sheets (TDS) 6. MODEL QUALITY ASSURANCE PLAN (QAP) FOR EXCITATION SYSTEM & EXCITATION TRANSFORMER			C 16. Tests on DVRs: Regulation Signal Flow Test Accuracy Test Voltage Regulation Test on No Load Regulation Test Under Over and Under Excitation Slip Stabilizer Test Stator and Rotor Current Limiter Load Angle Limiter Test (N -1) Limiter Test Check of Sequence/Reference Auto & Manual Operation Start & Stop Sequence Test	These tests shall be part of commissioning test.	Please adhere to bid specifications (Mentioned Test shall be carried out by simulation method during FAT. However, Voltage Regulation Test on No Load, Regulation Test under Over and Under Excitation, Slip Stabilizer Test and (N -1) Limiter Test are not existing in MQAP.
21.	Chapter 14 Clause 14.1.5		Clause 14.1.5	Cl 14.1.5 ADSS Cable	Kindly confirm the distance between power house and colony. Steel poles required for laying of cables shall be in scope of NHPC. Please Confirm	Please refer layout drawings Tender Provisions are clear
22.	Chapter 14 Clause 14.1.4		C14.1.4	C14.1.4 Link between Uri 1 stage 1 & Uri 1 stage-II	Kindly confirm the distance between both the projects and also inform the laying method. Please also confirm that cable shall be in NHPC scope; Please confirm FO cable will be connected at both via LIU to respective RTU at both end.	Please refer layout drawings Tender Provisions are clear
23.	Chapter 14 Clause 14.1.2		C14.1.2	C14.1.2 One set of RTM at corporate office	Kindly confirm that FO cable/ any media between Power House to Corporate Office shall be in NHPC scope	Confirmed. Tender Provisions are clear