



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT

PROJECT : 2×660 MW SEZ ENNORE STPP
PACKAGE : PRETREATMENT PLANT
TENDER ENQUIRY NO.: PE/PG/EN1/E-5512/2016 dtd. 18.03.2017

DATE: - 28.04.2017

Corrigendum-02

In reference to the above mentioned tender enquiry for PRETREATMENT PLANT package, there are following changes in tender enquiry:

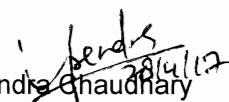
1. Amendment-1 of the technical specification along with Annexure-A is enclosed herewith.
2. Format for Steel and Concrete quote is enclosed herewith.
3. Reply of pre-bid queries is enclosed herewith.

All the other terms and conditions of the tender enquiry remain unchanged. All the bidders are requested to quote accordingly.

If any bidder(s) has submitted its offer already, then these bidders are requested to submit the revised offer (if desire so) in view of the changes in technical specification.

Bidders are requested to ensure submission of offer on or before due date i.e. by 12.05.2017.

Regards


Upendra Chaudhary
Dy. Mgr./ PG-II



**A E N D E N T N TECHNICAL SPECIFICATION FOR PRE-TREATMENT PLANT
2 0 E N N R E S E S T P P**

SPECIFICATION NO.: PE-TS-412-158-A001

AMENDMENT NO # 1

REV. NO. 00 DATE: 13/08/2015

Page 1 of 4

The following modifications with respect to Technical Specification for Pre Treatment Plant BHEL's Technical specification no **PE-TS-412-158-A001** shall apply.
Bidder to note that existing clauses/details as appearing in the specification stands deleted and clauses/details as mentioned in "Modified to or Read as" column shall be applicable and complied by the bidder as listed below in **SCHEDULE A**.

SCHEDULE A

MODIFIED CLAUSES PARAGRAPHS.

Sl no.	ol. No.	Section Description	Clause no	Page no	Existing clause details	Modified to or Read as
1.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	xxix.	13 of 880	The pipe sizes indicated in the tender specification/ flow Diagram are minimum. Wherever pipe sizes are not indicated, the same shall be selected based on the specification requirement and shall be subject to BHEL/ customer approval during detailing engineering. All pipes shall be carbon steel unless exclusively mentioned.	The pipe sizes indicated in the tender specification/ flow Diagram are minimum. Wherever pipe sizes are not indicated, the same shall be selected based on the specification requirement and shall be subject to BHEL/ customer approval during detailing engineering.
2.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	xxxvii.	14 of 880	Bidder to note that civil of Chemical House shall be done by BHEL. However, all the other necessary inputs for construction of foundations of equipment etc. shall be provided by the bidder.	The referred clause shall be read as deleted.
3.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	xxxviii.	14 of 880	RCC pedestals design and construction for all piping of PT plant except chemical house shall be in bidder's scope.	The referred clause shall be read as RCC pedestals design for all piping of PT plant except chemical house shall be in bidder's scope.
4.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	1.13	19 of 880	CONTROL PHILOSOPHY	The referred clause shall be read as deleted. Please refer to the Annexure-A for revised control philosophy.
5.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	Annexure-I	41 to 48 of 880	Standard Quality Plan for Programmable Logic Controller.	The referred clause shall be read as deleted.
6.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	Annexure II	49 to 91 of 880	Sub Vendors List	The referred clause shall be read as deleted. Please refer to the Annexure-A for revised Sub Vendors List
7.	IIB	SECTION - IA SPECIFIC TECHNICAL	Annexure VI	113 to 132 of 880	Mandatory Spares List.	The referred clause shall be read as deleted. Please refer to the Annexure-A for revised



**A E N D E N T N TECHNICAL SPECIFICATI N F R PRE-TREAT ENT PLANT
2 0 E N N R E S E S T P P**

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AMENDMENT NO # 1

REV. NO. 00 DATE: 13/08/2015

Page 2 of 4

		REQUIREMENTS (MECHANICAL)				Mandatory Spares List.
8.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	1.14	20 of 880	Break-up (%) of Supply prices of Pre Treatment plant package. (To be used during contract execution for payment).	The referred clause shall be read as deleted. Please refer to the Annexure-A for Break-up (%) of Supply prices of Pre Treatment plant package. (To be used during contract execution for payment).
9.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	6.2	164 of 880	Capacity (Net output)-940 cum/hr	The referred clause shall be read as:- Capacity (Net output) each - 1160 cum/hr.
10.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	10.5	165 of 880	First floor- Location of all chemical dosing tanks and pumps and Control room for PLC for entire PT Plant.	The referred clause shall be read as First floor- Location of all chemical dosing tanks and pumps and Control room for DCS for entire PT Plant.
11.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)		170 of 880	P&ID FOR PRETREATMENT PLANT	The referred clause shall be read as deleted. Please refer to the Annexure-A for P&ID FOR PRETREATMENT PLANT
12.	IIB	SECTION - IC SPECIFIC TECHNICAL REQUIREMENTS (CONTROL & INSTRUMENTATION)		179 to 186 of 880	SPECIFIC TECHNICAL REQUIREMENTS (CONTROL & INSTRUMENTATION)	The referred clause shall be read as deleted. Please refer to the Annexure-A for SPECIFIC TECHNICAL REQUIREMENTS (CONTROL & INSTRUMENTATION)
13.	IIB	SECTION - IIC GENERAL TECHNICAL REQUIREMENT (CONTROL AND INSTRUMENTATION)		316 to 525 of 880	GENERAL TECHNICAL REQUIREMENT (CONTROL AND INSTRUMENTATION)	The referred clause shall be read as deleted. Please refer to the Annexure-A for GENERAL TECHNICAL REQUIREMENT (CONTROL AND INSTRUMENTATION)
14.	IIB	SECTION - IIA GENERAL TECHNICAL REQUIREMENT (MECHANICAL)		195 880	p) Necessary flushing arrangement for the sludge pipes and filter back wash water disposal pipes. cl. no q to w	p) The referred clause shall be read as unnecessary flushing arrangement for the sludge pipes. The cl.no q to w shall be read as deleted.
15.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	Annexure VIII	139 to 140 of 880	ANNEXURE VIII : WATER ANALYSIS	The referred clause shall be read as deleted. Please refer to the Annexure-A for revised WATER ANALYSIS
16.	IIB	SECTION - IIA GENERAL TECHNICAL REQUIREMENT (MECHANICAL)	1.3	190 of 880	The type of clarifier shall be High Rate Solid Contact type	The referred clause shall be read as The type of clarifier shall be clariflocculator type.



**A END ENT N TECHNICAL SPECIFICATI N F R PRE-TREAT ENT PLANT
2 0 ENN RE SE STPP**

SPECIFICATION NO.: PE-TS-412-158-A001

AMENDMENT NO # 1

REV. NO. 00 DATE: 13/08/2015

Page of 4

17.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	6.2	164 of 880	Inlet valves:- One (1) number motorized butterfly flow control valve, located at inlet to aerator, with manual upstream and downstream isolation valves along with by-pass manual butterfly flow valve. Control valve shall have "auto manual" selection option, position indicator with "open/close" push buttons. Inching operation of valve shall be possible from PLC based control panel.	The referred clause shall be read as Inlet valves:- Two (2) numbers motorized butterfly flow control valve, located at inlet to aerator, with manual upstream and downstream isolation valves along with by-pass manual butterfly flow valve. Control valve shall have "auto manual" selection option, position indicator with "open/close" push buttons. Inching operation of valve shall be possible from DCS based control panel.
18.	IIB	SECTION - IIA GENERAL TECHNICAL REQUIREMENT (MECHANICAL)	10.0 C	198 of 880	Capacity rate- 1000 cum/hr (Minimum)	The referred clause shall be read as Capacity rate- 500 cum/hr (each).
19.	IIB	SECTION - IIA GENERAL TECHNICAL REQUIREMENT (MECHANICAL)	4.3 (g)	194 of 880	Coagulant (Alum) Dosing system consisting of 2 nos. dosing tank and 2 x 100% capacity dosing pumps complete with associated piping and valves.	The referred clause shall be read as deleted.
20.	IIB	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	1.5	16 of 880	TERMINAL POINT:- a) Raw water: 20m from Aerator central shaft at 0.5m above FGL. b) Service Water and Instrument Air: 5m at 0.5m above FGL from PTP chemical House.	TERMINAL POINT:- a) Raw water: 20m from Aerator central shaft at 0.5m above FGL. b) Service Water: 5m at 0.5m above FGL from PTP chemical House. Line Size shall be 50 NB. c) Potable Water: - Pipe length from Hypo dosing pump to outlet of potable water pump shall be 300 m. All the necessary fitting and flanges needed for connection at outlet header of potable water pump discharge shall be in scope of bidder. d) From discharge of sludge transfer pumps to guard pond shall be 300m.
GENERAL						
1.					GEO-TECHNICAL INVESTIGATION & FOUNDATION SYSTEM	Refer Annexure-A.
2.					Contour Map with Part Plot Plan for PT Plant	Refer Annexure-A.



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PRE- TREATMENT PLANT**

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

ANNEXURE II: SUB END RS LIST



TITLE

**2X660 MW, ENNORE SEZ STPP
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PRE- TREATMENT PLANT**

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

S.R. N .	ITE	SUPPLIERS	PLACE	RE AR S
1.	PRESSURE ESSELS	GLOBAL STRUCTURES & COMPOSITE LTD	-	
		JASMINO POLYMERTECH	TALOJA	
		SYSCON ENGINEERS	AMBERNATH	
		S.V. FABRICATORS	NAVI MUMBAI	
		SPARK FABRICATORS / STEELCON	-	
		ANUP ENGINEERING	AHMEDABAD	
		MURTHAL TANKS & VESSELS	SONEPAT	
		TITAN ENGG.	DURGAPUR	
		RISHI INDUSTRIES	BAHALGARH	
		UNIVERSAL HEAT EXCHANGERS	-	
		ATS CHEM	SALEM/HOSUR	
		CHEM PROCESS SYSTEM	SANAND	
		PROGEN	CHENNAI	
		CRYSTAL ENGINEERING	HOSUR	
		ISHAN EQUIPMENTS	VADODARA	
2.	AT SPHERIC ST RA E TAN S	GLOBAL STRUCTURES & COMPOSITE LTD	-	
		JASMINO POLYMERTECH	TALOJA	
		SYSCON ENGINEERS	AMBERNATH	
		S.V. FABRICATORS	NAVI MUMBAI	
		SPARK FABRICATORS / STEELCON	-	
		ANUP ENGINEERING	AHMEDABAD	
		MURTHAL TANKS & VESSELS	SONEPAT	
		TITAN ENGG.	DURGAPUR	
		RISHI INDUSTRIES	BAHALGARH	
		UNIVERSAL HEAT EXCHANGERS	-	
		ATS CHEM	SALEM/HOSUR	
		CHEM PROCESS SYSTEM	SANAND	
		PROGEN	CHENNAI	
		CRYSTAL ENGINEERING	HOSUR	
		ISHAN EQUIPMENTS	VADODARA	
.	RUBBER LININ AT SH P	TEMSEC	KOLKATA	
		RISHI INDUSTRIES	SONEPAT	
		CORI ENGINEERS	CHENNAI	
		POLY RUBBER	MUMBAI	
		INDUSTRIAL LINING	VADODARA	
		ARUL RUBBERS	CHENNAI	
		JASMINO POLYMERTECH	TALOJA	
		WESTERN RUBBER	NAVI MUMBAI	
		ELASTOMER LINNING	AMBERNATH	



TITLE

2X660 MW, ENNORE SEZ STPP
TECHNICAL SPECIFICATION FOR
PRE- TREATMENT PLANT

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

S.R. N.	ITE	SUPPLIERS	PLACE	RE AR S
		EMKAY RUBBER	MUMBAI	
4.	AIR BL ERS T IN L BE T PE	SWAN PNEUMATIC	NOIDA	
		EVEREST TRANSMISSION	NEW DELHI	
		KAY INTERNATIONAL	NEW DELHI / SONEPAT	
		EVEREST BLOWER	BAHADURGARH	
		KULKARNI POWER TOOLS	KOLHAPUR/ PUNE	
5.	ETERIN PU PS	VK PUMPS	NASIK	
		MILTON ROY INDIA	CHENNAI	
		SWELLORE	AHMEDABAD	
		POSITIVE METERING PUMPS	NASIK	
		METACHEM	MUMBAI	
	A ITAT R	REMI PEOCESS PLANT & M/C	MUMBAI	
		FIBRE & FIBRE	MUMBAI / SILVASA	
		CEECONS	CHENNAI	
		STANDARD ENGINEERS	MUMBAI	
	H RI NTAL CENTRIFU AL PU PS	BEST AND CROMPTON ENGG LTD.	CHENNAI	
		BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWMORE LTD.	GURGAON	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
		KIRLOSKAR BROTHERS LTD	PUNE	
		WILO MATHER & PLATT PUMPS PVT. LTD.	PUNE	
		V-FLO PUMPS & SYSTEMS CO. LTD.,	BEIJING-CHINA	
		WPIL LIMITED	KOLKATA	
8.	ERTICAL CENTRIFU AL PU PS	BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWMORE LTD.	GURGAON	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
		WILO MATHER & PLATT PUMPS PVT. LTD.	PUNE	
		SULZER PUMPS INDIA LTD.	THANE	
		WPIL LIMITED	KOLKATA	
	SCRE PU P	UT PUMP		
		ROTO PUMPS		
		TUSHACO		
10.	H RI NTAL CENTRIFU AL PU PS RUBBER LINED	KISHORE PUMPS	PUNE	
		SU MOTORS	MUMBAI	
11.	N N ETALLIC PP FRP H RI NTAL CENTRIFU AL	ENGINEERS COMBINE	THANE	
		ANTICORROSIVE	VALSAD	



TITLE

**2X660 MW, ENNORE SEZ STPP
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PRE- TREATMENT PLANT**

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

SR. N.	ITE	SUPPLIERS	PLACE	RE AR S
	PU PS	LEAK PROOF PUMPS PVT. LTD. (RAJEDIA)	-	
12.	ISC. PU P ERTICAL TURBINE T PE	KBL	PUNE	
		M&P	PUNE	
		WPIL	GHAZIABAD	
		KISHORE PUMPS	PUNE	
		FLOWMORE	SAHIBABAD	
		CHHABI ELECTRICALS PVT.LTD.	JALGAON	
		CHLORIDE POWER SYSTEMS & SOLUTIONS LIMITED	KOLKATA	
		DUBAS ENGG PVT LTD	BANGALORE	
		HBL POWER SYSTEMS LTD	HYDERABAD	
		JEMA ENERGY	SPAIN	FOR STATIC SCR TYPE FULL WAVE FULLY CONTROL TYPE
		MASS-TECH CONTROLS PVT.LTD.	MUMBAI	
		STATCON POWER CONTROLS LTD	NOIDA	
1	UNDER BED N LE	JONSONS SCREEN	AUSTRALIA/ IRELAND	
14.	C ATIN RAPPIN ATERIAL TAPE	IWL LTD.	CHENNAI	
		MP TAR PRODUCT	BHILAI	
		PORWAL INDUSTRIES	RAIPUR	
		RUSTECH	KOLKATA	
		STP	JAMSHEDPUR	
15.	HEATER	ESCORTS	FARIDABAD	
		RACOLDS	FARIDABAD	
1	CLARIFIER THIC ENER ECHANIS	CLEAR WATER	DELHI	
		TRIVENI	NOIDA	
		PBJ ASSOCIATE	PUNE	
1	CENTRIFU E	HUMBOLT	-	
		HILLER	-	
18.	CAST IR N ATE L NR SR	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		G.M. DALUI AND SONS PVT.LTD.	HOWRAH	
		H.SARKER AND COMPANY	HOWRAH	
		LEADER VALVES LTD.	JALANDHAR	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
1	BALL AL E ANUAL PNEU ATIC ELECTRIC CLASS 150	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	

	TITLE 2X660 MW, ENNORE SEZ STPP TECHNICAL SPECIFICATION FOR PRE- TREATMENT PLANT	SPECIFICATION NO. PE-TS-412-158-A001		
		SECTION-IA		
		REV 00		
SR. N .	ITE	SUPPLIERS	PLACE	RE AR S
		ATAM VALVES PVT. LTD.	JALANDHAR	
		DEMBLA VALVES LTD.	THANE	
		M/S GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	
		INTERVALVE (INDIA) LTD.	PUNE	
		LEADER VALVES LTD.	JALANDHAR	
		MICROFINISH VALVES PVT LTD.	HUBLI	
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	
		VAAS AUTOMATION PVT. LTD.	NEW DELHI	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
		NGEF	BANGALORE	
		KIRLOSKAR ELECTRIC CO LTD.		
		ASEA BROWN BOVERI		
		MARATHON	KOLKATA	
20.	BUTTER-FL AL E	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		INSTRUMENTATION LTD.	PALAKKAD	
		INTERVALVE (INDIA) LTD.	PUNE	
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED	NAVI MUMBAI	
		UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED,	KOLKATA	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
21.	DIAPHRA AL E ANUAL PNEU ATIC CLASS 150	WEIR BDK	HUBLI	
		CRANE FLOW PROCESS	SATARA	
		PROCON	MUMBAI	
		MAJESTIC VALVES (LABLINE)	-	
		HAWA ENGINEERS	AHMEDABAD	
22.	DUAL PLATE CHEC AL ES	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	1. DUAL PLATE CHECK VALVE CI - CLASS 150 & UP TO 600NB, 2. DUAL PLATE CHECK VALVE CCS - CLASS



TITLE

**2X660 MW, ENNORE SEZ STPP
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SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

SR. N .	ITE	SUPPLIERS	PLACE	RE AR S
				150 & UP TO 500NB
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CI ,CCS & STAINLESS STEEL SPRING ASSISTED DUAL PLATE CHECK VALVES UPTO 700 NB AND 150 CLASS RATING.
2 .	-T PE STRAINER STRAINER ATER SER ICE	OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		GRAND PRIX	NEW DELHI	
		JAYPEE	NEW DELHI	
		GREAVES COTTON	MUMBAI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI / NOIDA	
		FILTRATION ENGINEERS (I) PVT. LTD	MUMBAI	
		FLUIDNYE	-	
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		BHATIA ENGINEERING CO.	DELHI	
24.	RUBBER FLAP T PE CHEC AL ES	ASHVIK VALVES	-	
		FLOW WAY VALVES	-	
		BDK	-	
		MAJESTIC VALVES (LABLINE INST)	-	
		ADVANCE VALVES	-	
25.	S LEN ID AL ES	ROTEX	-	
		AVCON	-	
2 .	CHAIN PULLE BL C	ARMSEL MHE PVT. LTD	BANGALORE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 10 TONNE.
		TRACTEL TIRFOR INDIA PVT. LTD.	FARIDABAD	
		TECHNO INDUSTRIES	AHMEDABAD	
		ARMSEL MHE PVT. LTD	BANGALORE	
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	UPTO 20 TONNES
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD,	



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SECTION-IA

REV 00

SR. N .	ITE	SUPPLIERS	PLACE	RE AR S
		GLOBAL TECHNOLOGIES	HYDERABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	
		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
2	ELECTRIC H IST	ARMSEL MHE PVT. LTD	BANGALORE	
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	UPTO 20 TONNES
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD,	
		GLOBAL TECHNOLOGIES	HYDERABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	
		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
28.	C NTR L AL E	SPX CORPORATION, USA	AHMEDABAD	
		CONTROL COMPONENT INC.	CALIFORNIA	
		DRESSER VALVE INDIA PVT. LTD	COIMBATORE	
		DAUME REGELARMATUREN GMBH,	GERMANY	
		EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	CHENNAI	
		WEIR VALVES & CONTROLS UK LTD.	U.K	
		HOLTER REGELARMATUREN GMBH & CO.KG	GERMANY	
		INSTRUMENTATION LTD.	KERALA	



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SECTION-IA

REV 00

SR. N .	ITE	SUPPLIERS	PLACE	RE AR S
		KOSO INDIA PRIVATE LIMITED,	NASHIK	
		LESLIE CONTROLS, INC	USA	
		MIL CONTROLS LTD.	KERALA	
		METSO SINGAPORE PTE. LTD.,	SINGAPORE	
		PARCOL S.P.A	ITALY	
		R.K.CONTROL INSTRUMENTS PVT. LTD.	THANE	
		RINGO VALVULAS S.L,	SPAIN	
		SHENJIANG VALVE CO. LTD.	CHINA	
		VALVITALIA S.P.A. ,	ITALY	
		WALDEMAR PRUSS ARMATURENFABRIK GMBH	GERMANY	
		ASHCROFT INDIA PVT LTD.	GUJARAT	
		BUDENBERG GUAGE CO.LTD.	UK	
		FORBES MARSHALL (HYD) LTD.	HYDERABAD	
		GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	GOA	
		GOA THERMOSTATIC INSTRUMENTS PVT.LTD.		
		GAUGE BOURDON INDIA PVT. LTD.	MUMBAI	
		H.GURU INDUSTRIES	KOLKATA	
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGALORE	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	
		FLOW STAR ENGINEERING PVT. LTD.,	FARIDABAD	
		FLOWTECH INSTRUMENTS SERVICRS	VADODARA	
		INSTRUMENTATION ENGINEERS PVT LTD	TELANGANA	
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI	
		ABB	-	
		HONEYWELL	-	
		V AUTOMAT	-	
		YOKOGAWA	-	
		SIEMENS	-	
		FORBES MARSHALL	-	
		YOKOGAWA	-	
		HONEYWELL	-	
		ABB	-	
		HACH	-	
		FORBES MARSHALL	-	
		APC	BANGALORE	
		DELTA	GURGAON	



TITLE

2X660 MW, ENNORE SEZ STPP
TECHNICAL SPECIFICATION FOR
PRE- TREATMENT PLANT

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

SR. N .	ITE	SUPPLIERS	PLACE	RE AR S
		EMERSON	MUMBAI	
		DB POWER	PUNE	
		APLAB	MUMBAI	
		COMET	-	
		DOWELL	-	
		CHETNA	-	
2 .	S PLATES	SAIL		
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		
		LLOYD		
		ISPAT		
		INDIAN IRON & STEEL CO. LTD		
0.	CS PIPE AST A 10 R. B	INDIAN SEAMLESS METAL TUBES	AHMEDABAD	UPTO 150 NB
		MAHARASHTRA SEAMLESS	RAIGAD	UPTO 350 NB
1.	S PIPES IS: 12 58	SAIL	ROURKELA	
		JINDAL	GHAZIBAD/HISSAR	
		SURYA ROSHNI	BAHADUR GARH	
		TATA TUBE	JAMSHEDPUR	
		PSL	CHENNAI/VIZAG/KUTCH/DAMAN	
		LALIT PROFILE	THANE	
		SAMSHI PIPES INDUSTRIES	VADODARA	
		MUKUT PIPES	RAJPURA	
		INDUS TUBES	G B NAGAR	
		MANN IND	INDORE	
		SURENDRA ENGG	RAJPURA	
		PRATIBHA PIPES & STRUCTURE PVT LTD	THANE	
		JCO GAS PIPE	CHINDWARA	
		NUKAT TANKS AND VESSELS	TARAPUR	
		DADU PIPES	SIKANDRABAD	
		GOOD LUCK TUBES	SIKANDRABAD	
		ADVANCE STEEL TUBES	SAHIBABAD	
		BIHAR TUBES	SIKANDRABAD	
		HI TECH PIPES	SIKANDRABAD	
		RATNAMANI	KUTCH/AHMEDABAD/CHHATR AL	



TITLE

2X660 MW, ENNORE SEZ STPP
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SECTION-IA

REV 00

S.R. N .	ITE	SUPPLIERS	PLACE	RE AR S
		MAHARASHTRA SEAMLESS	RAIGAD	
		WELSPUN	ANJAR/BHARUCH	
	2.SS PIPES TUBES	APEX TUBES	BEHROR (ALWAR)	
		RATNAMANI	CHATTRAL	
		REMI	TARAPUR	
		PRAKASH STEELAGE	-	
		RADIANT CABLES	HYDERABAD	
		POLYCAB	DAMAN	
		KEI	BHIWADI	
		NICCO	KOLKATA	
		RAVIN CABLES	PUNE	
		INCAB	PUNE	
		HVPL	FARIDABAD	
		TORRENT CABLE	NADIAD	
		HAVELLS	ALWAR	
		PARAMOUNT	KHUSHKHERA	
		SRI RAM CABLES	BHIWADI	
		THERMOCABLES	HYDERABAD	
		TORRENT CABLE	NADIAD	
		UNIVERSAL CABLES	SATNA	
		GEMSCAB	BHIWADI	
		DELTON	FARIDABAD	
	3.SAFETY SH ER	UNICARE	-	
		MOHAN INDUSTRIES	-	
		SUPER SAFETY SERVICES	-	
	4.FRP TANKS FITTINGS	GLOBAL COMPOSITE	-	
		EPP	-	
		DEEPA COMPOSITE	-	
		COROSEAL INDUSTRIES	-	
		CHEMICAL PROCESS & EQUIPMENT PVT LTD	-	
		J.R FIBRE INDUSTRIES PVT LTD	-	
		POLYPLAST	-	
	5. ELECT R	ESSEM TECHNOLOGIES	-	
		RATNA PRASAD	-	
		POSITRONICS	-	
		DELTA CONTROL	-	
		L & T	-	



TITLE

**2X660 MW, ENNORE SEZ STPP
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SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

SR. N .	ITE	SUPPLIERS	PLACE	RE AR S
		GE POWER	-	
		PYROTECH	-	
		C S	-	
	TAN FRP	INDUSTRIAL SERVICE	KOLKATA	
		SUNRISE	BARODA	
		GANDHI & ASSOCIATES	AHMEDABAD	
		MODERN EQUIPMENTS	CHENNAI	
		EAGLE PLAST	PUNE	
		OMEGA PLAST	MUMBAI	
		METACHEM	MUMBAI	
		SWELORE	AHMEDABAD	
		MILTON ROY INDIA	CHENNAI	
	SAFET AL ES RELIEF AL ES	METACHEM	MUMBAI	
		KEYSTONE	BARODA	
		V K PUMPS	NASIK	
		MILTON ROY	CHENNAI	
8.	DUPL E STRAINER	JAYPEE INDUSTRIES PVT. LTD.	NEW DELHI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI	
		OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		SUNGOV ENGINEERING PVT. LTD.	CHENNAI	
	RIFICE PLATE	MICRO PRECISION	FARIDABAD	
		INSTRUMENTAION LTD	PALGHAT	
		CARLO DYNAMICS	HYDERABAD	
		A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	(1) CARBON STEEL GATE VALVES & NON RETURN VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 300 NB (#150) (2) CARBON STEEL GLOBE VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 200 NB (#150)
40.	STEEL ATE L BE NR AL ES	FLUIDLINE VALVES COMPANY PVT.LTD.	KAUSHAMBI	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C)SUPPLIER NOT REGISTERED FOR NR



TITLE

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SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

SR. N .	ITE	SUPPLIERS	PLACE	RE AR S
				VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.,	NAVI MUMBAI	LIMITED TO RANGES & CLASSES AS AVAILABE IN VD FILE.
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT- UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500, GLV-BBT- UPTO300NB CL UPTO600,SCNRV-BBT- UPTO600NB CL UPTO150,SCNRV-BBT- UPTO300NB CL 300,SCNRV-PSBT- UPTO150NB CL UPTO900
		VALTECH INDUSTRIES	MUMBAI	
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
41.	SLUICE ATE	H SARKAR	KOLKATA	
		JASH ENGINEERING	-	
		YASHWANT INDUSTRIES	-	
42.	A AL E	HI TECH	AHMEDABAD	
		ADVANCE VALVES PVT.LTD	NOIDA	
		BDK	HUBLI	
		FOURESS ENGG.INDIA LTD.	MUMBAI	
		FLUIDLINEVALVES COMPANY PRIVATE LTD.,	MUMBAI	
		INSTRUMENTATION LTD.	PALAKAD	
		KIRLOSKAR BROTHERS LTD.	PUNE	
		VENUS PUMP & ENGG. WORKS	KOLKATA	
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY	CHENNAI	
		STAFFORD CONTROLS LIMITED	PUNE	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
4 .	PLU AL E ANUAL	BDK	HUBLI	
		HAWA ENGINEERS / MARCK & CARE	-	
		MICON VALVES	-	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
44.	FITTIN S CS SS	M.S. FITTINGS	KOLKATA	



TITLE

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SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

SR. N.	ITE	SUPPLIERS	PLACE	RE AR S
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
45.	FLAN ES SS CS	PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCOROPORATION	BARODA	
		MS FITTINGS	KOLKATA	
		HAWA ENGINEERING	-	
		ALIANCE PIPE & PLANGES	KOLKATA	
		JAI AMBE	MUMBAI	
4.	PIPE FILLTIN PP HDPE P C CP C	GEROGE FISHCHER	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
4.	AL ES ATE L BENR BA LL - PP HDPE P C CP C	GEROGE FISHCHER IPING SYSTEMS PVT LTD	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
48.	AIR FILTER RE ULAT R	SHAVO NORGEN	-	
		PLACKA INSTRUMENTS	-	
4.	FILTER EDIA	GLOBAL ABSORBENT	KOLKATA	
		BHARAT MINERALS		
50.	DC LEAD ACID NI-CD BATTERIES	AMCO SAFT INDIA LTD	BANGALORE	NI-CD BATTERIES ONLY
		EXIDE INDUSTRIES LTD	NEW DELHI	LEAD ACID BATTERIES ONLY.
		HBL POWER SYSTEMS LTD	HYDERABAD	NI/CD AND TUBULAR TYPE FOR LEAD ACID
		HOPPECKE BATTERIEN GMBH & CO.KG,	GERMANY	
51.	DC LEAD ACID BATTERIES	EXIDE INDUSTRIES LTD	NEW DELHI	
		HBL POWER SYSTEMS LTD	HYDERABAD	TUBULAR TYPE
		HOPPECKE BATTERIEN GMBH & CO.KG,	GERMANY	
52.	DC NI CD BATTERIES	AMCO SAFT INDIA LTD	BANGALORE	
		HBL POWER SYSTEMS LTD	HYDERABAD	



TITLE

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SECTION-IA

REV 00

SR. N.	ITE	SUPPLIERS	PLACE	RE AR S
		HOPPECKE BATTERIEN GMBH & CO.KG,	GERMANY	
5	SI HT FL INDICAT RS	B.K.EQUIPMENTS PVT.LTD.	CHENNAI	
		BLISS ANAND PVT. LTD.	GURGAON	
		FLOWTECH INSTRUMENTS SERVICRS	VADODARA	
		INSTRUMENTATION ENGINEERS PVT LTD	TELANGANA	
		SIGMA INSTRUMENTS CO.	MUMBAI	
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI	
		TELACE EQUIPMENT PVT.LTD.	CHENNAI	
54.	PAINT	ASIAN PAINTS (I) LTD.		
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		
55.	PNEU ATIC ACTUAT R	PROCON ENGINEERS	-	
		TYCO	-	
		CRANE PROCESS	-	
		BDK	-	
		INTERVALVE	-	
		BRAY CONTROL	-	
5	T RISED ACTUAT R	ROTARK	-	
		AUMA	-	
		LIMITORK	-	
5	LT T RS	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	
		BHARAT BIJLEE LTD.	BHARAT BIJLEE LIMITED, 1ST FLOOR, 7-B, RAJINDRA PARK, PUSA ROAD, NEW DELHI - 110 060.	
		CROMPTON GREAVES	3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA	
		GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE,	



TITLE

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SPECIFICATION NO.

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SECTION-IA

REV 00

SR. N .	ITE	SUPPLIERS	PLACE	RE AR S
			EKKADUTHANGAL, GUINDY, CHENNAI-600032	
		KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555 , MALLESWARAM WEST ,BANGALORE 560055	
		LAXMI HYDRAULICS PVT. LTD	129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR-413003, MAHARASHTRA	
		MARATHON	MARATHON ELECTRIC INDIA PRIVATE LTD.SECTOR - 11, MODEL TOWN, FARIDABAD - 121006	
		NGEF	POCKET NO.10, FLAT NO. 37 & 38, EXPANDABLE DDA FLATS, NASIRPUR DWARKA, PHASE-I NEW DELHI-110 045	
		RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053	
		SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	
58.	UNCTI N B ES	Jasper Engineers Pvt. Ltd.	A-23, SECTOR - 8, NOIDA- 201301	
		Electro Controls & Devices	F-41, SITE-C, SURAJPUR INDUSTRIAL AREA GREATER NOIDA, UTTAR PRADESH :201308	
		M/s Shrenik & Co.	39A/3, PANCHRATNA INDUSTRIAL ESTATE, SARKHEJ-BAVLA ROAD, CHANGODAR, AHMEDABAD – 382 213	
		M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115	
		Adroit Control Engineers Pvt.Ltd.	PLOT-3, KRISHNA INDL. AREA, SECTOR-25 FARIDABAD – 121004	
		M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115	
		MIKA ENGINEERS	BRANCH OFFICE : 'D'-101, DHEERAJ HERITAGE RESIDENCY II, SHASTRI NAGAR, SANTACRUZ (W), MUMBAI 400 054.	
		M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115	
		BAJAJ ELECTRICALS	ENGINEERING & PROJECTS BU (NORTH) 3rd FLOOR, GULMOHARHOUSE, COMMUNITY CENTRE 161/B-4, GAUTAM NAGAR, YUSUF	



TITLE

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SECTION-IA

REV 00

SR. N .	ITE	SUPPLIERS	PLACE	RE AR S
			SARAI NEW DELHI – 110049	
		AJMERA INDUSTRIES & ENGG. WORKS	AJMERA INDL. AND ENGG. WORKS. AJMERA HOUSE, A-61 / KHAIRANE MIDC. , TTC INDL. AREA, NAVI MUMBAI – 400705.	
		S.B. ELECTRICAL ENGINEERING CORPORATION	03, SARDAR GRIHA BUILDING, LOHAR CHAWAL, MUMBAI- 400002	
5	DC BATTER CHAR ER	AMARA RAJA POWER SYSTEMS LIMITED	TAMIL NADU	
		CHHABI ELECTRICALS PVT.LTD.	MAHARASHTRA	
		CHLORIDE POWER SYSTEMS & SOLUTIONS LIMITED	KOLKATA	
		DUBAS ENGG PVT LTD	BANGALORE	
		EMERSON NETWORK POWER (INDIA) PVT. LTD.	MAHARASHTRA	
		HBL POWER SYSTEMS LTD	HYDERABAD	
		JEMA ENERGY (For Static SCR Type Full Wave fully Control type)	Lasarte-Oria--SPAIN	
		MASS-TECH CONTROLS PVT.LTD.	MUMBAI-MAHARASHTRA	
		STATCON POWER CONTROLS LTD	NOIDA-UTTAR PRADESH	
0	DC NI-CD BATTER	AMCO SAFT INDIA LTD	BANGALORE-KARNATAKA	
		HBL POWER SYSTEMS LTD	HYDERABAD-TELANGANA	
1	DC LEAD ACID BATTER	EXIDE INDUSTRIES LTD	NEW DELHI	
		HBL POWER SYSTEMS LTD (FOR TUBULAR TYPE)	HYDERABAD-TELANGANA	
		HOPPECKE BATTERIEN GMBH & CO.KG,	HOPPECKE, GERMANY	
2	LU S	DOWELLS	47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	
		UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001	
		ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA	
		ARUP ENGG & FOUNDRY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	
		BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI-600018	
		COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063	
		DOWELLS	47/47A, SATGURU INDUSTRIAL ESTATE.OFF AAREY ROAD,	



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PE-TS-412-158-A001

SECTION-IA

REV 00

SR. N .	ITE	SUPPLIERS	PLACE	RE AR S
			GOREGOAN (EAST). MUMBAI 400 063.	
		ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	
		INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001	

Sl. No.	Package Name	Vendor Name	Approval Status for Ennore Project
CONTROL AND INSTRUMENTATION (C&I) PACKAGES			
1	ANUBAR (DELTA TUBE)	STAR-MECH CONTROLS (I) PVT.LTD.	Approved
		TM TECNOMATIC SPA	Credentials Required
		SWITZER INSTRUMENT LTD.	Approved
2	CONTROL VALVE	RINGO VALVULAS S.L,	Credentials Required
		Severn Glocon India Pvt. Ltd.	Credentials Required
		CONTROL COMPONENT INC.	Approved
		DRESSER VALVE INDIA PVT. LTD	Credentials Required
		LESLIE CONTROLS, INC	Credentials Required
		SPX Corporation, USA	Credentials Required
		Daume Regelarmaturen GmbH,	Credentials Required
		INSTRUMENTATION LTD.	Approved
		Valvitalia S.P.A. ,	Credentials Required
		WEIR VALVES & CONTROLS UK LTD.	Approved
		Koso India Private Limited,	Credentials Required
		FORBES MARSHALL ARCA PVT.LTD.	Approved
		R.K.CONTROL INSTRUMENTS PVT. LTD.	Approved
		EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	Approved
		HOLTER REGELARMATUREN GmbH & Co.KG	Credentials Required
		MIL CONTROLS LTD.	Approved
		SHENJIANG VALVE CO. LTD.	Credentials Required
		Metso Singapore PTE. LTD.,	Approved
		DeZURIK - COPES VULCAN LTD., U.K.	
		FISHER SANMAR LIMITED	
		INTROL-ABB	
		CONTINENTAL VALVES LTD	
		FOURESS ENGG. INDIA LTD.	

Sl. No.	Package Name	Vendor Name	Approval Status for Ennore Project
3	FLOW ELEMENT - NOZZLE	HYDROPNEUMATICS PVT. LTD.	Approved
		INSTRUMENTATION LTD.	Approved
		MICRO PRECISION PRODUCTS PVT. LTD.	Approved
		STAR-MECH CONTROLS (I) PVT.LTD.	Approved
		SEIKO FLOW CONTROL GMBH	Approved
		BRISTOL BABCOCK LTD. UK	
		BALIGA LIGHTING EQUIPMENTS PRIVATE LIMITED, CHENNAI	
		ENGINEERING SPECIALITIES PRIVATE LTD	
4	FLOW ELEMENT - ORIFICE	MICRO PRECISION PRODUCTS PVT. LTD.	Approved
		INSTRUMENTATION LTD.	Approved
		HYDROPNEUMATICS PVT. LTD.	Approved
		Flow Star Engineering Pvt. Ltd.,	Approved
		STAR-MECH CONTROLS (I) PVT.LTD.	Approved
		MINCO (INDIA) PRIVATE LIMITED	Approved
		INSTRUMENTATION ENGINEERS PVT LTD	Approved
		BRISTOL BABCOCK LTD. UK	
		BALIGA LIGHTING EQUIPMENTS PRIVATE LIMITED, CHENNAI	
		ENGINEERING SPECIALITIES PRIVATE LTD	
5	PROGRAMMABLE LOGIC CONTROLLER	GE Intelligent Platforms Private Limited	Approved
		SIEMENS LIMITED	Approved
		ROCKWELL AUTOMATION INDIA LTD	Approved
		SCHNEIDER ELECTRIC INDIA PVT.LTD.	Approved
		Honeywell Automation India Limited	Approved
6	ROTAMETER	FLOWTECH INSTRUMENTS SERVICES	Approved
		Flow Star Engineering Pvt. Ltd.,	Approved
		EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	Approved
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Approved
		INSTRUMENTATION ENGINEERS PVT LTD	Approved
		CHEMTROLS SAMIL (INDIA) PVT. LTD., MUMBAI	

Sl. No.	Package Name	Vendor Name	Approval Status for Ennore Project
7	ULTRASONIC FLOW TRANSMITTERS	New Package	
8	SIGHT FLOW INDICATORS	TELACE EQUIPMENT PVT.LTD.	Credentials Required
		BLISS ANAND PVT. LTD.	Approved
		B.K.EQUIPMENTS PVT.LTD.	Approved
		SIGMA INSTRUMENTS CO.	Approved
		FLOWTECH INSTRUMENTS SERVICES	Approved
		INSTRUMENTATION ENGINEERS PVT LTD	Approved
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Approved

Package Code	Package Name	Vendor Name	Vendor Communication Address
145-04000-A	CONTROL VALVE	PARCOL S.p.A	Mr. Erminio Campanelli, Via Isonzo, 2, Canegrate MI Phone- 0349-7417774 Pincode : 200010 Email : mazurizio.para@parcol.com
145-04000-A	CONTROL VALVE	FORBES MARSHALL ARCA PVT.LTD.	A-34/35 , MIDC ESTATE, H-BLOCK, PIMPRI, PUNE, Phone- 020-27442020, Pincode : 411018 Email : mnadgaundi@forbesmarshall.com
145-04000-A	CONTROL VALVE	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpvt.com
145-04000-A	CONTROL VALVE	MIL CONTROLS LTD.	Mr.Jacob Cherian/Mr.Geo Jolly Meladoor, Annamanada P.O. MALA, Thrissur Phone- 0480-2695700 Pincode : 680741 Email : biju.simon@ksb.com
145-04000-A	CONTROL VALVE	Koso India Private Limited,	H 33 & 34, MIDC, Ambad, Nashik, Phone- 91 944 744 3198 Pincode : 422010, Email : seemaanand_sa@koso.co.in
145-04000-A	CONTROL VALVE	BOMAFI SPECIAL VALVE SOLUTIONS PVT LTD	Mr. K.M. Anklesaria/ R. M. Anklesaria Plot No: 285/2, Panchratna Estate, Near Ramol Bridge, Vatva Ahmedabad Phone- 079-40083825 Pincode : 382445 Email : info@bomafi-india.com
145-04000-A	CONTROL VALVE	SUZHOU DELAN ENERGY SCIENCE & TECHNOLOGY CO., LTD.	No 566 Fangqiao Road Caohu Industrial Park, Xiangcheng Economic Development Zone, Suzhou Phone- 008618012776062 Pincode : 215143 Email : jeanielei@delan-valve.com
145-04000-A	CONTROL VALVE	WALDEMAR PRUSS ARMATURENFABRIK GMBH	Mr. Winfried Dremhel Schulenburgstrasse 261, Hannover Phone- +49- 511279260 Pincode : 30419 Email : dremhel@pruss.de; vogel@pruss.de
145-04000-A	CONTROL VALVE	Valvitalia S.P.A. ,	Mr. Salvatore Ruggeri Via Tortona 69, Rivanazzano (Pavia) Phone- +39- 03839459875 Pincode : 27055 Email : gianluca.angelieri@valvitalia.com
145-04000-A	CONTROL VALVE	HOLTER REGELARMATUREN GmbH & Co.KG	HOLTER REGELARMATUREN GmbH & Co.KG , Helleforthstrasse 58-60, D 33758 Schloss Holte- Stukenbrock Germany Phone- 0049-05207/88037 Pincode : Email : mail@hora.de
145-04000-A	CONTROL VALVE	R.K.CONTROL INSTRUMENTS PVT. LTD.	PLOT NO.A-250, OPP.POLICE STATION, WAGLE INDUSTRIAL ESTATE, THANE Phone- 25820943/2331 Pincode : 400604 Email : rkcipl@vsnl.com ; rkcinpvt@bol.net.in
145-04000-A	CONTROL VALVE	SPX Flow Technology (I) Pvt. Ltd.	Survey No 275, Odhav Road, Odhav Ahmedabad Phone- +91 (0) 8939963099 Pincode : 382415 Email : siva.prakash@spx.com
145-04000-A	CONTROL VALVE	Daume Regelarmaturen GmbH,	Mr. Björn Carstensen Am Springbrunnen 23, Barleben Phone- 9820805424, Pincode : 39179 Email : madhu@aumvn.com, info@daume- regelarmaturen.de,
145-04000-A	CONTROL VALVE	EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	147, KARAPAKKAM VILLAGE, CHENNAI Phone- 23722184, 23716242 Pincode : 600096 Email : jatinder.singh@emerson.com
145-04000-A	CONTROL VALVE	DRESSER VALVE INDIA PVT. LTD	Mr. Raj Raman/Mr. Rajkumar Moria S.F. No: 608,Chettipalayam Road, Echanari Post, Coimbatore Phone- +91-98451 19085 Pincode : 641021 Email : Anoop.Ramachandran@ge.com
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	Michael Weileder Dorn Assenheimer, Strasse 27 Reichelsheim Phone- +91- 9999107840 Pincode : D-61203 Email : msingh@barksdale.de
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, No.127 & 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : marketing@switzerinstrument.com
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdresh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdresh@sherman-india.com,
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	B-20-21, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD Phone- 0120- 2712016 Pincode : Email : mktg@indfos.com
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	S.No. 36/1/1, Sinhgad Road, Vadgaon Khurd, Near Lokmat Press, Pune, Phone- 020-24393577, Pincode : Email : pressure@vsnl.com,

145-07000-A	ANALYTICAL INSTS.SAMPLE COOLER	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com
145-07000-A	ANALYTICAL INSTS.SAMPLE COOLER	FORBES MARSHAL PVT. LTD.	A-33/34, MIDC ESTATE, H-BLOCK, PIMPRI, PUNE Phone- 27470171,27477472 Pincode : 411018 Email : nkaushal@forbesmarshall.com
145-07000-A	ANALYTICAL INSTS.SAMPLE COOLER	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
145-10000-A	TEMPERATURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com
145-10000-A	TEMPERATURE GAUGE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,
145-10000-A	TEMPERATURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com
145-10000-A	TEMPERATURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
145-10000-A	TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	FLAT -B , GF, HILL CROWN APTS., COLLEGE ROAD, MAPUSA Phone- Pincode : 403525 Email : gtilworks@pyro-electric.in
145-10000-A	TEMPERATURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
145-10000-A	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in
145-10000-A	TEMPERATURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
145-10000-A	TEMPERATURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com
145-11000-A	LEVEL GAUGE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
145-11000-A	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com
145-11000-A	LEVEL GAUGE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
145-12000-A	FLOW ELEMENT	MICRO PRECISION PRODUCTS PVT. LTD.	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD Phone- 9810265688 Pincode : 121002 Email : pal@microa1.com
145-12000-A	FLOW ELEMENT	TM TECNOMATIC SPA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzocc VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@tmtecnomatic.com
145-12000-A	FLOW ELEMENT	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net

145-12000-A	FLOW ELEMENT	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com
145-13000-A	TEMP. ELEMENT	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	320, TV INDUSTIAL ESTATE, OFF.DR.A.BESANT ROAD, BEHIND GLAXO, WORLI, MUMBAI Phone- 24934125,24938403 Pincode : 400025 Email : trivtech@vsnl.com
145-13000-A	TEMP. ELEMENT	Tempsens Instrument (I) Pvt Ltd	MR. V.P.RATHI/MR. HEMANT RATHI B-188A ROAD NO.5 , M.I.A UDAIPUR Phone- 09352420069 Pincode : 313003 Email : info@tempsens.com
145-13000-A	TEMP. ELEMENT	Thermal Instrument India Pvt. Ltd.	Mr. Raghavendra M. Kulkarni 194/195, Gopi Tank Road Behind Citylight Cinema,Mahim Mumbai Phone- 09322664709 Pincode : 400016 Email : ramk@giconindia.com
145-13000-A	TEMP. ELEMENT	TM TECNOMATIC SPA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzocc VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@tmttecnomatic.com
145-13000-A	TEMP. ELEMENT	TECHNO INSTRUMENTS	Abhijit Gohel/Mr. Amit Pandya Plot No. 1145/1, Uma Convector Lane, Santej,Ta. Kalol, Gandhinagar Phone- 9909925223 Pincode : 382721 Email : amit@techno-instruments.com
145-13000-A	TEMP. ELEMENT	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
145-13000-A	TEMP. ELEMENT	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.	M. D. BICHU/R. M. BICHU G.B, HILL CROWN APARTMENTS, COLLEGE ROAD, MAPUSA Phone- 9326114601 Pincode : 403507 Email : priyanka.marketing@pyro-electric.in
145-13000-A	TEMP. ELEMENT	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,
145-13000-A	TEMP. ELEMENT	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
145-13000-A	TEMP. ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,
145-14000-A	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com
145-14000-A	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
145-14000-A	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,
145-14000-A	TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
145-14000-A	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,
145-14000-A	TRANSMITTERS	ABB LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com
145-14000-A	TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
145-14000-A	TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
145-14000-A	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,
145-14000-A	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com
145-14000-A	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in
145-14000-A	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com
145-14000-A	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com
145-14000-A	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com
145-15000-A	TEMPERATURE SWITCH	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com

145-15000-A	TEMPERATURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com
145-15000-A	TEMPERATURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
145-15000-A	TEMPERATURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com
145-15000-A	TEMPERATURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, No.127 & 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : marketing@switzerinstrument.com
145-16000-A	SIGHT FLOW INDICATORS	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
145-16000-A	SIGHT FLOW INDICATORS	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
145-16000-A	SIGHT FLOW INDICATORS	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
145-16000-A	SIGHT FLOW INDICATORS	B.K.EQUIPMENTS PVT.LTD.	T. BALAKRISHNAN/S.VENKATESH 217 , ARCOT ROAD PORUR , CHENNAI Phone- 9444057761 Pincode : 600116 Email : bkequip@gmail.com
145-16000-A	SIGHT FLOW INDICATORS	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
145-16000-A	SIGHT FLOW INDICATORS	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@iefflowmeters.com
145-25000-A	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net
145-25000-A	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com
145-25000-A	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com
145-25000-A	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com
145-25000-A	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, jmajmera@yahoo.com
145-32000-A	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
145-32000-A	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
145-32000-A	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
145-32000-A	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
145-34000-A	ROTAMETER	Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.in
145-34000-A	ROTAMETER	TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaindia@gmail.com
145-34000-A	ROTAMETER	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@iefflowmeters.com
145-34000-A	ROTAMETER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
145-34000-A	ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	Mr V. K. Pandit/Mr Ashish Shaha 17-20, Royal chambers, Paud Road Pune Phone- 9370469466 Pincode : 411038 Email : sales@eurekaflow.com
145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com

145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA Phone- 033-22290045 Pincode : 700016 Email : sandeep@hitech.in
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.	Mr. N R Shenoy/Mr G B Viji 8, First Floor.Plot : 160A Bait-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI Phone- 09892331381 Pincode : 400050 Email : ramanbpl@vsnl.com
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
145-37000-A	LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
145-37000-A	LEVEL SWITCH-FLOAT TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
145-37000-A	LEVEL SWITCH-FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata Phone- 033-2415-1310. Pincode : 700031 Email : dkinst@vsnl.net
145-37000-A	LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
145-37000-A	LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com
145-37000-A	LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com
145-37000-A	LEVEL SWITCH-FLOAT TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
145-37000-A	LEVEL SWITCH-FLOAT TYPE	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
145-37000-A	LEVEL SWITCH-FLOAT TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
145-37000-A	LEVEL SWITCH-FLOAT TYPE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
145-38000-A	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91- 9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
145-38000-A	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
145-38000-A	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
145-38000-A	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
145-40000-A	VIBRATION MONITORING SYSTEM	MEGGITT INDIA PVT. LTD.	LJ Swaminathan/Gaurav Anand Unit-04A, Level-02, Bagmane Laurel Bagmane Tech Park, CV Raman Nagar Bangalore Phone- +91-9731577119 Pincode : 560093 Email : gaurav.anand@meggitt.com
145-40000-A	VIBRATION MONITORING SYSTEM	FORBES MARSHALL PVT. LTD.	A - 34/35, MIDC ESTATE, H- BLOCK, PIMPRI, PUNE Phone- 020-27442020, Pincode : 411 018 Email : mvyas@forbesmarshall.com
145-40000-A	VIBRATION MONITORING SYSTEM	SKF INDIA LIMITED	Mr. Shishir Joshipura SERVICE BUSINESS UNIT, CHINCHWAD, PUNE Phone- +91 982 3161755 Pincode : 411033 Email : sandeep.gadre@skf.com
145-40000-A	VIBRATION MONITORING SYSTEM	ROCKWELL AUTOMATION INDIA PVT LTD	A-66, SEC- 64, NOIDA, Phone- 0120-4671236 Pincode : 201301 Email : raindia@ra.rockwell.com; asharma@ra.rockwell.com
145-40000-A	VIBRATION MONITORING SYSTEM	GE INDIA INDUSTRIAL PVT. LTD.	Mr. Pramod Kaushik/Vijay Pal BUILDING NO-7A, 4TH FLOOR GURGAON Phone- 0124-4808515 Pincode : 122002 Email : vijay.pal@ge.com
145-42000-A	ULTRASONIC FLOW METERS	CHEMTROLS INDUSTRIES LTD	Mr. K. NANDAKUMAR AMAR HILL, SAKI VIHAR ROAD, POWAI, MUMBAI Phone- 022-67151261 Pincode : 400072 Email : manikandan@chemtrols.com

145-42000-A	ULTRASONIC FLOW METERS	Rockwin Flowmeter India Pvt. Ltd.	B-24, Site-IV, Sahibabad Industrial Area Ghaziabad, Phone- 9810129687 Pincode : 201010, Email : amiya@rockwin.com
145-42000-A	ULTRASONIC FLOW METERS	FLASH FORGE PVT LTD	Mr. Gautam Makker, 503, 'A'-wing, Delphi, Orchard Avenue Road, Powai Mumbai Phone- 022-42784300 Pincode : 400076 Email : hemendrapatil@f- f.co.in
145-42000-A	ULTRASONIC FLOW METERS	NIVUS GMBH	Mr. Marcus Fischer Im Taele 2, D - 75031 Eppingen Phone- 00491712233770 Pincode : Email : carolin.schuster@nivus.com
145-43000-A	FLOW ELEMENT - ORIFICE	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net
145-43000-A	FLOW ELEMENT - ORIFICE	TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaindia@gmail.com
145-43000-A	FLOW ELEMENT - ORIFICE	MICRO PRECISION PRODUCTS PVT. LTD.	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD Phone- 9810265688 Pincode : 121002 Email : pal@microa1.com
145-43000-A	FLOW ELEMENT - ORIFICE	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum Phone- 0831- 4210386 Pincode : 590008 Email : yogish@dyna-fluid.com
145-43000-A	FLOW ELEMENT - ORIFICE	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com
145-43000-A	FLOW ELEMENT - ORIFICE	HYDROPNEUMATICS PVT. LTD.	Mr. DM Bichu G/B, Hill Crown Apts., College Road Mapusa Phone- 0832- 2360364 Pincode : 403507 Email : ajayrc@hydropneumatics.co.in
145-43000-A	FLOW ELEMENT - ORIFICE	Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.in
145-43000-A	FLOW ELEMENT - ORIFICE	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com
145-45000-A	INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
145-45000-A	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-fit.com
145-45000-A	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com
145-45000-A	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
145-45000-A	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com
145-45000-A	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com
145-45000-A	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com
145-45000-A	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91- 9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
145-45000-A	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
145-45000-A	INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
145-47000-A	ELECTROMAGNETIC FLOW METER	Adept Fluidyne Pvt. Ltd.	Vinayak Gadre Plot No 4,S.No.17/1-B Kothrud Industrial Estate Pune Phone- 020 25464551 Pincode : 411038 Email : info@adeptfluidyne.com
145-47000-A	ELECTROMAGNETIC FLOW METER	Electronet Equipments Pvt Ltd.	Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 020-2026932039 Pincode : 411048 Email : ho@eeplindia.com

SI No.	Package Name	Vendor Name	LOCATION
2	ANALYSERS (ALL TYPES)	ABB INDUSTRIES AG	SWITZERLAND.
		ROSEMOUNT ANALYTICAL INC	IRVINE
		ENDRESS + HAUSER INDIA PVT. LTD.	MUMBAI
		HACH LANGE S.A.R.L CH-1222,	VESENAZ
		SWAN Analytische Instrumente AG, CH-8340	Hinwii
		METTLER-TOLEDO INDIA PVT. LTD.,	MUMBAI
		THERMO ORION INC	BEVERLY
5	MOTORISED ACTUATOR	ROTARK	UK
		AUMA	Bengaluru
		WEIR BDK VALVES	Hubli
		LIMITORQUE	Faridabad
6	AIR FILTER REGULATOR	PLACKA	Chennai
		SHAVO-NORGREN	Mumbai
		SCHRADER SCHORILL DUNCAN LTD.	Mumbai
		FAIRCHILD	USA
		SMC PNEUMATICS	Noida
7	SOLENOID VALVE	ASCO	USA
		ROTEX	Vadodra
		SCHRADER	Pune
		AVCON	Mumbai
		HERION-NORGREN	Germany
		IMI-NORGREN	Germany
		JAFFERSON	Argentina

	TITLE 2X660 MW, ENNORE SEZ STPP TECHNICAL SPECIFICATION FOR PRE- TREATMENT PLANT	SPECIFICATION NO. PE-TS-412-158-A001
		SECTION-IA
		REV 00
1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL. BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED. 2. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY. 3. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.		

**TITLE**

**2X660 MW, ENNORE SEZ STPP
TECHNICAL SPECIFICATION FOR
PRE- TREATMENT PLANT**

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

ANNEXURE I: MATERIAL SPARES LIST



TITLE

**2X660 MW, ENNORE SEZ STPP
TECHNICAL SPECIFICATION FOR
PRE- TREATMENT PLANT**

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

SL. No.	Equipment Package name	Qty.
	PRETREATMENT PLANT	
1	CIRL DIAPHRAGM VALVE	
a.	Complete valve	Two (2) Nos. each of different size of valve in the system
b.	Diaphragm	Five (5) Nos. each of different sizes valves
c.	Valve spindle	Two (2) Nos. each of different sizes valves
2	Other type valve (except Control Valve)	
a.	Complete valve	One (1) No. each of different size of valve in the system
b.	Sampling & needle valve	Four (4) Nos. each type & size
3.	Pressure Gauge	Two (2) Nos. for each Range/Type
4.	Level Gauge	
a.	Glass Tube	Five (5) Nos. for each size
b.	Off-set value	Two (2) Nos. for each size
5	Level Switch (conductivity type)	
a.	Float & Rod Float & Rod	One (1) No. for each size
b.	Switch Assembly	One (1) No. for each size
6	Clariflocculator Bridge	
a.	Worm gearbox	One (1) No.
b.	Shaft for trailing wheel	One (1) No.
c.	Flocc. Drive head complete with bevel & pinion set.	One (1) No.
d.	Central bearing housing complete.	Two (2) Sets
e.	Current collectors.	One (1) Set
f.	Weir with stuffing box.	One (1) No.
g.	Bearing; Impeller with shaft & gear unit for each type and size of air blowers.	Two (2) Sets
h.	Floats for each size and type with links & levers	Two (2) Sets
i.	Bearings & brake linings for each type & rating of hoists.	Two (2) Sets
j.	Rope grid & complete length of wire rope for each type of hoists rating	One (1) No.
k.	Bearings; shaft sleeve; impeller; and mechanical seal for each type & duty parameters of pump sets.	One (1) set each
l.	Controller valve assembly complete.	Two (2) No.
m.	Periphery drive worm gearbox coupling.	Two (2) No.



TITLE

2X660 MW, ENNORE SEZ STPP
TECHNICAL SPECIFICATION FOR
PRE- TREATMENT PLANT

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

.0	415 otors	
	Terminal plates	10 Nos. each for small motors upto 30 kW & 4 Nos. each for more than 30 kW
	Heaters	2 sets
	Greasing arrangements	4 sets each type of motor
	Motor of each type and rating	10% of the installed quantity or minimum 1 number whichever be higher
	Bearings (DE and NDE) for each type and rating of motor	4 sets
8.0	BATTER	
	Battery cell	10 nos.
	MT cell container of each type	10 nos.
	Level indicator	6 nos.
	Vent plugs	12 nos.
	Inter-cell connector	10 nos.
	Set of nuts, bolts and washer	12 nos.

SI no	Name of spares	Unit	Qty
1.0.0		INSTRUMENTATION	
(I)	Each type of lamps, PBs, ILPBs, fuse, MCB, MCCB used in the equipment/system.	Nos.	20 % of Installed of each type.
1.00.01	Measuring Instruments		
1.00.01.01	Indicators, Recorders, Electrical Metering and Skid Mounted Instruments		
(i)	Indicators, recorders and meters offered from each model for the project. These instruments shall be supplied with three sets of blank scales.	Nos.	10 % of Installed of each type/Model or a minimum of one number for each model and type, whichever is more
(ii)	For skid mounted instruments (as applicable)	Nos.	10% of total number of instruments for each Type and model or a minimum of one number for each model and type, whichever is more
1.00.01.02	Temperature Elements and Thermowells		

SI no	Name of spares	Unit	Qty
(i)	Thermocouple/RTD elements	Nos.	10% spare for each type and length of element furnished with thermocouple/RTD assemblies, or a minimum of one number of each type & length, whichever is more.
(ii)	Thermowells	Nos.	10% for each type of temperature sensors or a minimum of one for each type, whichever is more
1.00.01.03	Temperature,Transmitters and Electronic Transmitters (For Pressure, DP, Temp, Flow, Level), Temperature, Pressure, Flow & Level Switch, safety switches, Gauges, meters, Transducer or any other instrument etc.	Nos.	10% of total number of Instruments/transducers offered for each model and type for the project or a minimum of one number, whichever is more.

Sl no	Name of spares	Unit	Qty
1.00.06.11	Electronic modules of each type & rating for UPS and DC control power supply system.	Set	One set of with each set consisting of at least one number of each type of electronic module for inverters, chargers, static switch, stabiliser etc. as per approved BOM.
1.00.06.12	MCCB for UPS & 24 V DC charger panels, ACDB, DCDB.	Nos.	20 % of installed or 5 Nos of each type (which ever is more)
1.00.07	Erection hardware		
1.00.07.01	Instrument valves	Nos.	Ten (10) percent of each type & Size installed
1.00.07.02	Condensate pots of each type & Size installed	Nos.	Ten (10) percent of total number of Installed or four numbers whichever is higher .
1.00.07.03	Manifold	Nos.	Ten (10) percent of each type & Size installed
1.00.07.04	Fittings	Nos.	Ten (10) percent of each type & Size installed
1.00.08	LVS		
1.00.08.01	LEDs	Nos.	20% (Installed) spares of each type & size.
1.00.08.02	LVS Filters	Nos.	50% spare or min 6 nos.
1.00.08.03	Electronic cards of each type for LVS	Nos.	3 nos. or 20% whichever is more
1.00.08.04	Interfacing cables	Set	Two Set of each type & size.

SI no	Name of spares	Unit	Qty
1.00.11.01	As per Manufacturer's Recommendation for Three Years Continuous Operation or minimum quantities indicated as below (whichever is more)		
1.00.11.02	Electronic cards/Module/Mother Board /Signal Processing Unit for each type of Analyzer	Nos.	One no. of each type
1.00.11.03	Power supply module	Nos.	One no. of each type for each analyser
1.00.11.04	UV Lamp with adopter with SO2 analyser.	Nos.	One no. of each type
1.00.11.05	Light source and detector unit for SPM and NOX/SOX analyser.	Nos.	One no. of each type for each analyser
1.00.11.06	Pump for SPM Analyser	Nos.	One no. of each type
1.00.11.07	Conference hall mic.	Nos.	Two no. of each type
1.00.11.08	Conference hall speakers.	Nos.	Two no. of each type
1.00.12	HMS		
1.00.12.01	As per Manufacturer's Recommendation for Three Years Continuous Operation	Set	
1.00.12.02	Electronic cards	Nos.	One no. of each type
1.00.13	Mandatory Spares for Control valves, Power Cylinder, Control Dampers, Actuators and Accessories		
(A)	Following spares shall be furnished for control valves, Power Cylinder, Control Dampers as applicable.		
	One set of spare control valve stem packing for each control valve.		

SI no	Name of spares	Unit	Qty
	Two moulded rubber diaphragms for each control valve.		
	One sets of each of O-rings and rubber gaskets for each control valve.		
d)	100 percent qty. of lubricants for gaskets for each control valve on one year consumption basis.		
	2 sets of limit switches and 1 set of valve positioner for each control valve.		
f)	20 percent of position transmitter (4-20mA) for total qty. of control valve.		
g)	One (1) set of valve trims (such as plug, stem, seat ring /cage, guide bushing, stem lock pin, packing retaining ring, etc) for each control valve.		
h)	One completes actuator of each type or min 10% for each type and size whichever is more.		
i)	20 percent of Solenoid valves or min 2 no. of each type for total qty. of control valves.		

SI no	Name of spares	Unit	Qty
j)	20% of I to P converters, Pressure regulators.		
B)	Mandatory spares for each critical applications special control valves as specified in NIT		
C)			
a.	Soft Goods Kit Valve	1 set	
b.	Metal seat	1 set	
c.	Seat Ring	1 set	
d.	Spindle	1 set	
e.	Actuator Soft Goods kit	1 set	
i.	Feed back transmitter unit	2 Nos.	
ii.	Electronic Position Transmitter	2 Nos.	
iii.	Solenoid valves	2 Nos.	
iv.	Air filter regulators	2 Nos.	
v.	Air Lock Relay	2 Nos.	
vi.	Complete Actuator for each type and model	1 set	

SI no	Name of spares	Unit	Qty
1)	2nos. acoustic transducer with rear connector sealed to IP-65		
2)	2 nos. flexible high temperatures lead, 3metre long for acoustic transducer.		
3)	2 nos. acoustic s field amplifier / processor mounted in a die cast aluminum or polycarbonate box sealed to IP-65 with mounting brackets, pairs.		
4)	1 no. A/D Convertor cards/field signal interface module for 32 or more channels.		
5)	1 no. Alarm relay output card.		
6)	Consumables like batteries, fuses etc. for two years operation of boiler tube leak detection system.		
1.00.15	Mandatory spares not covered above		
	Bidder to supply 10% or 1 no. (whichever is more) of each type of sensor/instrument, instrumentation/mechanical fittings etc for any other system		
1.00.16	OTHER RELATED CONTROL AND INSTRUMENTATION SYSTEMS/EQUIPMENTS		
1.00.16.01	Other SG related sub-systems		
1	Flame Monitoring System		

	TITLE 2X660 MW, ENNORE SEZ STPP TECHNICAL SPECIFICATION FOR PRE- TREATMENT PLANT	SPECIFICATION NO. PE-TS-412-158-A001
		SECTION-IA
		REV 00

1.1 C NTR L PHIL S PH

- i) The operation of the Pre-Treatment Plant shall be done from DDCMIS based. Two no. OWS, one no. Operating cum engineering station with one no. A3/A4 size colour LJP shall be provided. In addition Backup control desk with coloured Mimic, H.W. Annunciator, P.B. Ammeters, parameters Indicators, recorders and indication Lamps, Ammeters shall also be provided. Separate Local control panel is not envisaged.
- ii) A mimic with the status of drives including ON, OFF, TRIP indication of respective motors/pumps and control valve shall be provided on the OWS of DDCMIS.
- iii) All the dosing pumps shall be capable of being adjusted manually to any output with in the stated range.
- iv) All pumps shall trip at level low in respective tanks or Sumps.
- v) All remote indications from instruments as per P & ID such as raw water flow transmitter, opening / closing status and percentage positioning indicator for inlet motor operated flow control valve, level indicating controller for Clarified Water Tank etc. shall be available on the OWS.
- vi) Detailed control write-up of PT Plant shall be submitted after placement of order on PT plant vendor.
- vii) Alarm annunciations as per P & ID & as per system requirement and trip annunciation of all drives shall be displayed on OWS.
- viii) Local Start/Stop facility from individual pump shall be provided.
- ix) The dosing of chemical at various stages of process shall be controlled through Stroke controller in local through Stroke adjustment. The command for the same shall be issued from OWS of DDCMIS.
- x) The following pumps shall be started and stopped from DDCMIS.
 - a) Alum dosing pumps.
 - b) Lime dosing pumps
 - c) PE dosing pumps.
 - d) Naocl dosing pumps.
 - e) Sludge transfer pump.
- xi) Suitable arrangement by adjustable timers shall be provided for sludge blow down valve of Clarifier with the provision for manual intervention and adjustment independently.
- xii) Provisions for data transfer with reference to important parameters related with Pre Treatment Plant from PT Plant DDCMIS to main plant DDCMIS shall be made through soft link through OPC on Fiber optic.
- xiii) All pumps and agitators shall trip at level low in respective tanks.
- xiv) Alarms pertaining to Clarified water tank- Very High (VH), High (H), Low (L), Very Low (VL) shall be included in PT plant controls.
- xv) Torque trip for all the clarifier shall be provided.
- xvi) The dosing of chemical at various stages of process shall be controlled through Stroke controller in local through Stroke adjustment. The command for the same shall be issued from OWS of DDCMIS.
- xvii) Number of signals / Annunciation shall be provided in DDCMIS and the same shall be decided During Detailed Engineering stage.

**TITLE****2X660 MW, ENNORE SEZ STPP
TECHNICAL SPECIFICATION FOR
PRE- TREATMENT PLANT****SPECIFICATION NO.**

PE-TS-412-158-A001

SECTION-IA

REV 00

1.14 ADDITIONAL REQUIREMENT

- Bidder to submit BBU during detailed engineering after approval of Basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication is applicable to BHEL / customer for the same. None of the items supplied for the project as non-billable. Incomplete BBU shall not be review by BHEL.

Break-up (%) of Supply prices of Pre Treatment plant package. (To be used during contract execution for payment).	
Lump sum firm price for supply of Clarifier Mechanism along with accessories inclusive of all taxes, duties and other levies as applicable.	13% of Total supply price of Pre Treatment plant package.
Lump sum firm price for supply of pumps, blowers, agitators, Motors inclusive of all taxes, duties and other levies as applicable.	25% of Total supply price of Pre Treatment plant package.
Lump sum firm price for supply of Piping & fittings inclusive of all taxes, duties and other levies as applicable.	13% of Total supply price of Pre Treatment plant package.
Lump sum firm price for supply of Valves inclusive of all taxes, duties and other levies as applicable.	16% of Total supply price of Pre Treatment plant package.
Lump sum firm price for supply of Instrument & analysers inclusive of all taxes, duties and other levies as applicable.	18% of Total supply price of Pre Treatment plant package.
Lump sum firm price for supply of Misc. Balance Items inclusive of all taxes, duties and other levies as applicable.	15% of Total supply price of Pre Treatment plant package.

	2X660 MW ENNORE STPP	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
Specific Technical Requirements (C&I) 1. The Control of PTP shall be through standalone DDCMIS based control system which shall be in BHEL's scope. DDCMIS panels, UPS, OWS, OEWS & Printers shall be provided by BHEL. 2. The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire PTP. The requirements given are to be read in conjunction with detailed technical specification enclosed in the specification. Further in case of any discrepancy in the requirement noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per BHEL's interpretation shall be complied by the bidder during contract stage without any commercial implication to BHEL. 3. The instrumentation to be provided for PTP shall be as per the technical specification document / drawings wherever provided for the respective systems as a minimum requirement for bidding purpose. However for completeness of the system and its associated equipment, Bidder shall also provide all the necessary instruments to the process requirement even if it is not specifically indicated in the given technical Specification document / drawings. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any technical, commercial and delivery implication to BHEL. 4. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. 5. All the instruments/equipment/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply. 6. Instruments shall be suitable for sea or saline water application. MOC of impulse tubing & impulse pipe shall be CPVC (3/8") Sch 80 or better, Industrial grade up to manifold. MOC of impulse tubing, fittings (from manifold to instrument) and manifold shall be super duplex SS in case of sea water applications. 7. The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The proposal shall include the necessary cables, flexible		

	2X660 MW ENNORE STPP	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm². 8. All the instruments/drives shall be terminated on JB's in field. JB's shall be in Bidder's scope. Bidder to consider minimum 5 nos. of JB's. 9. All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. The same shall be in Bidder's scope. All transmitters shall be HART compatible. 10. All the instruments indicated in PID are minimum requirement and it is mandatory to use sensors/signals/measurements with 1 out of 2 logics for all control & interlock (Analog & Binary) application/service as explained below: Dual sensors shall be provided for instruments required for auto starting of LT driven pumps or LT driven pump tripping due to very low level of water/ discharge pressure very low. Dual measurement shall be employed for the measurements used for analog control functions. 11. All the instruments/ sensors/transmitters/switches meant for redundant applications shall have completely separate and independent impulse pipes/ root valves etc. No redundant instrument shall share a single process tapping. There will be separate and independent tapping for every individual instrument. 12. Doppler effect type flow meters shall be used for sludge applications. 13. DP instruments with min. Capillary length of 15m to be supplied in case of Installation in pit. 14. Instrument installation shall be as per the attached "Standard Hook-up diagram of instrument." 15. All motorised valves of 200NB or more than 200NB size shall be provided with integral motorized bypass valves on all process lines. 16. All motorised actuator shall be provided with conventional actuators with integral starter for ON/OFF valves. Non-contact type electronic 2- wire position transmitters shall be provided for all inching type motorised valves. The detailed specification is attached elsewhere in the specification. 17. Valve end position (Open & Close) shall be monitored for the manual critical valves, wherever provided.		

	2X660 MW ENNORE STPP	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
18. Bidder to comply with codes and standards as mentioned in the specification. 19. Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system. 20. All approval/Inspection are to be carried out by Owner or owner appointed agency only. 21. Bidder shall provide erection hardware as per installation drawings. 22. Bidder to provide mandatory spares as per mandatory spares list attached elsewhere in the specification. 23. Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. 24. Power Supply Requirement: Power supply for instruments, analysers etc. shall be provided at a single point which shall be decided during detail engineering. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement for instruments, analysers etc. to be arranged/derived by bidder by providing suitable control transformer. 25. All cables terminated in the terminal block, power distribution scheme instruments shall be ferruled. Ferruling shall be double cross ferruling (i.e.) source and destination addresses shall be marked on both sides of the tube ferruling. 26. Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification. 27. Number of pairs to be selected for Instrumentation cable (Size: 0.5 mm²): a) F-Type: 2P/4P/8P/12P/24P b) G-Type: 4P/8P/12P 28. Number of cores to be selected for Control cable (Size: 2.5 mm²): a) 3 Core b) 5 Core c) 12 Core 29. Each pneumatic device requiring air supply and intended for field mounting shall include a filter regulator air set with gauge, to owner's approval.		

	2X660 MW ENNORE STPP	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
30. Bidder's presence is required for 3 Man days (Excluding travel time) at EDN Bangalore during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic. Intimation to attained FAT shall be informed in 2 days advance. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope. 35. Contractor's C&I representative shall be present at BHEL-PEM for 3 man days, for preparation of Control scheme of PTP. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope. 36. Bidder's presence is required for 15 Man days (in three visit) at site during commissioning of DDCMIS for assistance related to process correctness. Three visit with total 15 Man days (Excluding travel time) in which one visit shall be of 5 Man days each. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope. 37. Bidder to ensure participation of their senior personnel and experts in discussions with Owners and other equipment bidders during various stages of contract implementation as required by the Owner.		



TITLE

2X660 MW, ENNORE SEZ STPP
TECHNICAL SPECIFICATION FOR
PRE- TREATMENT PLANT

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IIB

REV 00

SECTION IIC
GENERAL TECHNICAL REQUIREMENTS AND
INSTRUCTIONS

ACTUATORS



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.: PE-DG-412-145-1902

VOLUME II B

SECTION D

REV. NO. 02

DATE: 28.03.17

SHEET 1

OF 3

Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

DATA SHEET-B
(TO BE FILLED-UP BY BIDDER)

GENERAL*	* PROJECT	2x 660 MW ENNORE SUPERCRITICAL TPP		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	☐ ON / OFF ☐ INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY		
	* OPENING / CLOSING TIME			
	* WORKING PRESSURE			
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%		
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY		
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:68		
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL		
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.		
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.		
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.		
HANDWHEEL	* REQUIRED	☒ YES ☐ NO		
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED		
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.			
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY		
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY		
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT- INCLUSIVE OF I.S. TOLERANCE		
	ACTUATOR APPLICABLE WIRING DIAGRAM	☐ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☐ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram		
	COLOUR SHADE	☐ BLUE (RAL 5012) ☐		
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☒ EPOXY ☐		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY		
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY		
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V		



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.: PE-DG-412-145-1902

VOLUME II B

SECTION D

REV. NO. 02

DATE: 28.03.17

SHEET 2

OF 3

Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

DATA SHEET-B
(TO BE FILLED-UP BY BIDDER)

	@ ENCLOSURE CLASS OF MOTOR	☒ IP 68 ☐ FLAME PROOF			
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B			
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos., 1 IN EACH PHASE) ☐ -----			
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED			
INTEGRAL STARTER	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED			
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS ☐ THYRISTORS			
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)			
	STEP DOWN CONT. TRANSFORMER	☒ REQUIRED			
	OPEN / CLOSE PB	☒ REQUIRED ☐ NOT REQUIRED			
	STOP PB	☒ REQUIRED ☐ NOT REQUIRED			
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED			
	LOCAL REMOTE S/S	☒ REQUIRED ☐ NOT REQUIRED			
	STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED			
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (MOTOR THERMOSTAT TRIP, O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, PHASE LOSS, S/S IN LOCAL or OFF MODE, STOP PB OPTD, TORQUE OPEN/CLOSE CUTOFF)		1	
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☐ INTERPOSING RELAY ☐ OPTO COUPLER ☐ EITHER			
	QUANTITY	☒ 2 NOs. ☐ 3 Nos. *			
	DRIVING VOLTAGE	☒ 20.5 – 24V DC ☐ _____ V DC			
	DRIVING CURRENT	☒ 125mA MAX ☐ _____ mA MAX			
	LOAD RESISTANCE	☒ > 192 ohms - <25 k ohms ☐ > _____ ohms - < _____ ohms			
TORQUE SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY			
	OPEN / CLOSE	☒ 1 No. ☐ 2Nos. / ☒ 1 No. ☐ 2Nos			
	CONTACT TYPE	2 NO + 2 NC			
	RATING	5A 240V AC AND 0.5A 220V DC			
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE			
	ACCURACY	+3% OF SET VALUE			
LIMIT SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY			
	OPEN : INT : CLOSE	☐ 1 No. ☒ 2 Nos.	2 Nos. (ADJ.)	☐ 1 No. ☒ 2Nos.	
	CONTACT TYPE	2 NO + 2 NC			
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC			

*For inching type drives IPR 3 Nos. to be considered for inching operation.





SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.: PE-DG-412-145-1902

VOLUME II B

SECTION D

REV. NO. 02

DATE: 28.03.17

SHEET 3

OF 3

Data Sheet A & B

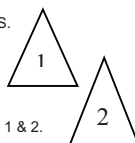
DATA SHEET-A
(TO BE FILLED BY PURCHASER)

DATA SHEET-B
(TO BE FILLED-UP BY BIDDER)

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	☒ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	☒ 24V DC ☐	
	OUTPUT	☒ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	230V AC, 1 PH., 50 Hz	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	@ ☒ IP 68 @ ☐	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET (9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	☐ REQUIRED ☒ NOT REQUIRED ☐ ☐ 2 NOS. ☐	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE: suitable for 3Cx2.5sq mm Cu	
	@ SPACE HEATER CABLE GLAND	SIZE:-	
	OTHER CONTROL CABLE GLANDS	QUANTITY & SIZE: Cable gland suitable for 8Px0.5 sq mm & 2P x 0.5 sq mm cable.	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.

NOTES:

1. **SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
 2. **CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
 3. ACTUATOR SHALL HAVE HARDWIRED CONTACTS FOR FOLLOWING SIGNALS (a) ACTUATOR IN LOCAL MODE (b) ACTUATOR IN REMOTE MODE
 4. BIDDER TO ENSURE AVAILABILITY OF SPARE 1NO + 1NC LIMIT SWITCH & TORQUE SWITCH.
 5. SS TAG NAME PLATE SHALL BE PROVIDED.
 6. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
 7. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, Ni PLATED BRASS MATERIAL SHALL BE PROVIDED.
 8. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
 9. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
 10. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
 11. LOCAL DIGITAL POSITION INDICATOR SHALL BE PROVIDED FOR INCHING DUTY DRIVES.
 12. COMMANDS SHALL BE LATCHED AT INTEGRAL STARTER END.
 13. SWITCHES SHALL BE TERMINATED IN JB MOUNTED ON ACTUATOR.
 14. ACTUATORS FOR HAZARDOUS AREA SHALL BE CERTIFIED FLAME PROOF FOR ZONES 1 & 2.
- \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.**
- ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.**



NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES

FIELD & MEASURING INSTRUMENTS

CHAPTER-3**FIELD AND MEASURING INSTRUMENTS****3.00.00 FIELD & MEASURING INSTRUMENTS (PRIMARY & SECONDARY INSTRUMENTS)****3.01.00 GENERAL REQUIREMENTS**

3.01.01 Instruments, control devices and other equipment accessories covered under this specification shall be furnished in accordance with I&C specification sheets and drawings enclosed herewith and the requirements of all applicable clauses of this specification.

3.01.03 The instrumentation/control equipment and accessories shall be from the latest proven design for which the performance and high availability have been demonstrated by a considerable record of successful operation in power station service for similar applications. The bidder shall furnish sufficient evidence to fully satisfy the Owner in this regard.

3.01.04 For plug in type instruments, The plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections. Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands for Explosion proof area, Flame proof area and high vibration prone area.

3.01.05 Every instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuse of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.

3.01.06 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anti corrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange shall also be included wherever required with the field instruments.

3.02.00 Following minimum requirement of field instruments shall be fulfilled by Bidder (In addition, Redundancy criteria for field instruments shall be as specified else where in specification): -



- iii. Level Transmitters (Type as per Owner approval) for open sump/tank/bunker/vessel/heaters.
- iv. Stand pipes on both side of tank for all level instruments (LT, LS & LG).
- v. Flow elements with flow transmitter & Flow meter for flow measurement of process medium as decided by owner
- vi. Pressure gauges and temp. Gauges at inlet and outlet of each heat exchanger and cooler.
- vii. DPG, DPT & DPS across the filters/strainers.
- viii. Tapping points/test points shall be provided.
- x. All Thermocouples & RTDs shall be Duplex.
- xi. All Field Instruments used in acid or alkaline atmosphere shall be with standard Anti corrosion coating i.e. the combination of Polyurethane and epoxy resin baked coating (ANSI/ISA-71.04).
- xii. All primary instruments installed at "Minus level or Floor" shall be with protection class of IP 68.
- xiii. Transmitters (all type) for monitoring & controls purpose.



- xvii All field mounted push button, selector switch etc. shall be as per IEC or NEMA 4X protection.
- xviii All limit switch shall be conform to IEC-60947-5-1.
- xxi. Temp. Transmitters are envisaged with RTD & Thermocouples for monitoring services/application only. However any RTD & Thermocouples are used for control, interlock & protection application, same shall be directly wired to DDCMIS/DCS/PLC using instrumentation & Extension cables respectively.
- xxii. As for the water flow/ steam flow measurements, **necessary flow elements/ transmitters are chosen in the process line and supplied such that their algebraic summation shall be mass balanced for calculating the system efficiency.**
- xxiii. Contacts less, electronic 2-wire position transmitters shall be provided for all inching type motorised valve
- xxiv. ~~For CW sump level, Raw water reservoir level, Turbine oil tank, coal bunkers, Ash Silo, LDO/HFO tank, DM water tanks, CS tank, Acid and alkali applications, only~~ non contact type level transmitters like Acoustic, Ultrasonic, Radar based shall be provided by bidders as approved by owner.
- xxvii. Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

FIELD INSTRUMENTS SHALL BE SUPPLIED & OFFERED AS PER DATA SHEETS SPECIFIED BELOW:



2 x 660 MW ENNORE SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT.No.03/2013-14

Vol. V /Sheet - 40



3.03.00 TRANSMITTERS, SWITCHES, GAUGES AND PANEL MOUNTED INSTRUMENTS**3.03.01 Pressure, Differential Pressure, DP type Level and Flow Transmitters (PT, DPT, LT & FT)**

Smart Transmitters of the electronic type shall be furnished.

Transmitters shall be equipped with mounting brackets suitable for a mounting in transmitter enclosures.

In general, Transmitters are envisaged to be grouped at several places as to be decided during detailed engg. stage. For this purpose, suitable enclosures complete with all tubing, fittings, purge meters, loop cable trays etc. shall be provided.

Type/Construction	:	Sealed capacitance/ Inductance/ Silicon resonance type
Material		
- Body	:	Die cast Aluminum with epoxy coating for air & flue gas SS316 for other services
- Diaphragm	:	316 SS
- Measurement element	:	Teflon seal
- Valves	:	Carbon steel for non-corrosive Applications SS316 for corrosive applications.
Output signal	:	4 to 20 m Amp. DC (Two wires) HART Compatible
Local Indicator	:	LCD indicator (5 digit) with scale of Engg. unit
Overall Accuracy	:	$\pm 0.04\%$ or better of Span for BTG package $\pm 0.065\%$ or better of Span for BOP packages $\pm 0.2\%$ or better of span for remote seal type transmitter.
Turn down ratio	:	100:1 in general
Stability	:	$\pm 0.15\%$ of URL for 5 years.
Response time	:	150 msec.
Power supply	:	24V DC nominal
Drive capability	:	600 Ohms nominal
Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
Span and Zero	:	Locally adjustable, non-interacting



Zero suppression / elevation : At least 100% of Span

Connection

- Process : 1. Half (1/2) inch NPT (F)
Quarter (1/4) inch NPT
with/without oval flanges

- Electrical : Suitable for Plug in type connection (Both side of transmitter), unused entry with blind plug.

Accessories

- For Absolute Pressure Transmitters: Two (2) valve SS316 manifold

- For Gauge & Vacuum pressure transmitter : Three (3) valve SS316 manifold

- For DP, level & flow transmitter : Five (5) valve SS316 manifold

- For oil and corrosive liquids : Separator diaphragm seals

- For all transmitters : Mounting bracket

Manifold should not be mounted on the transmitter, Manifold shall be non integral and standalone type. Snubbers/Pulsation dampners shall be used where the process media is unstable for measurement such as the discharge of a pump. Over range protection shall be used where necessary. The coil syphons & condensate pots shall be used for steam services. Transmitters shall be provided with suitable drain & vent points.

3.03.02 PRESSURE SWITCHES (PS) & DIFFERENTIAL PRESSURE SWITCHES (DPS)

Applicable Standards : IS3624 - 1966/ISA-RP-8.1 except as modified in spec.

Type/Construction : Bourdon/Sealed Diaphragm Piston
Actuated preferable. Indicators with contacts are not acceptable.

Materials

- Bellows : 316 SS

- Bourdon tube : 316 SS

- Movement : 316 SS

- Encloser : Die-cast aluminum with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere.

- Protective Diaphragm : Teflon



Accuracy	:	$\pm$ One (1) percent or better
Repeatability	:	$\pm$ 0.5(half) percent or better
Setting & Differential	:	Adjustable
Contact		
- Number	:	DPDT /2 SPDT
- Type	:	Auto reset with internal Adjustable snap action micro switch
- Rating	:	5 Amp, 240V AC / 0.2 Amp, 220V DC
Connection - instrument	:	Half (1/2) inch NPT Male Process
Electrical	:	Suitable for Plug in type connection. All the switches are internally connected and brought to the surface with Amphenol male/female connection. Cabling need not terminated inside the switch. Cable ends are to be soldered in connector and to be inserted for easy maintenance.
- Over range protection	:	One Fifty (150) percent of full scale
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
Accessories		
- 3 / 5 valve manifold	:	As applicable for all switches
- Self cleaning type pulsation dampners/Snubber (Material SS316)	:	Pump and compressor discharge lines
- Syphon	:	For all steam lines
- Protective separating diaphragm	:	For fuel oil & corrosive liquid lines.
Mounting	:	Local (in LIE/LIR for BTG package).

3.03.03 PRESSURE & DIFFERENTIAL PRESSURE GAUGES (PG & DPG)

Applicable standard	:	IS:3602-1966, IS/3624, ASME B 40.1
Type/Construction	:	
-760 mm to 1.0Kg/cm2	:	Bellows/Diaphragm
-Above1.0Kg/cm2	:	Bourdon Tube
- Suction side of pumps	:	Compound gauge
Materials		
- Bourdon tube	:	316 SS
- Bellows	:	316 SS
- Movement	:	316 SS
- Case	:	SS 316/ Die-cast aluminum with stoved enamel black finish. Epoxy coating



		shall be provided for corrosive atmosphere.
- Protective Diaphragm	:	Teflon
Dial size	:	150mm with shatter proof glass
Scale Details	:	Graduations in black lines on white dial, on white dial, 270 Deg. pointer deflection scale provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges.
Accuracy	:	$\pm$ One (1) percent or better
Connection - Instrument Process	:	1/2 inch NPT Male Bottom
Mounting	:	Local
	:	1/2 inch NPT Male (Back entry) mounted on local gauge board.
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)

Accessories

- 3 way needle valve/manifolds	:	For all gauges
- Self cleaning type	:	Pump and compressor discharge lines
Pulsation dampener/snubber (S316)	:	
- Syphon	:	For all steam lines
- Protective separating	:	For fuel oil and corrosive liquid lines

Other particulars

- External Zero adjustment	:	For all gauges
- Safety device	:	
Ranges 5 to 20 Kg/cm ²	:	Rubber blow out disc with open front construction.
Ranges above 20 Kg/cm ²	:	Neoprene safety diaphragm at the back with solid front construction.
- Over range protection	:	One Fifty (150) percent of full scale

Other Requirments

	:	Movement mechanism shall be glycerin filled for oil services & vibration prone area.
	:	For corrosive liquid lines diaphragm type sensors required. Armored capillary of 10 M for Corrosive liquid service.



: Contact type pressure gauges are not acceptable for interlock & protection.

3.03.04

TEMPERATURE TRANSMITTERS

Type	:	SMART type configurable from control room through HART protocol (HMS System).
Display type	:	Indicating type (5 digit LCD Display),
Accuracy	:	$\pm 0.10\%$,
Ambient temperature error	:	0.1% per 10°C change
Output	:	4-20 mA DC (2 wire system) HART compatible signals for analogue monitoring inputs to the distributed control system (DDCMIS), DCS & PLC.
Protection class	:	NEMA 4/IP66 or equivalent degree of protection for enclosure)/ (Explosion/Flame proof for NEC Class-1, Division 1 area)/ flame proof (IEC-79.1, Part I). As applicable).
Material of accessories	:	SS316.
Stability	:	$\pm 0.1\%$ or ± 0.1 deg C of reading (whichever is great) for 2 years in case of RTD inputs and for 1 year in case of Thermocouples inputs.
Operating Voltage	:	16 – 48 V DC
Calibration	:	as per NIST monograph 125 for T/C & European Curve Alpha = 0.00385 for RTD .
Ref. Junction compensation	:	Provided
Span/zero adjustment	:	Locally adjustable, Non interacting
Auto calibration	:	Provided
Burn out protection upscale	:	Provided
Input - output isolation	:	Provided
Circuit ungrounded	:	Provided

The Temperature transmitter shall accept Universal dual inputs of all types of thermocouples & RTD, 0-5V input signals etc.



Temp. Transmitter shall be extremely stable against Ambient temp variation, The accuracy figure shall be inclusive of effect due to ambient temperature variation.

3.03.05 RESISTANCE TEMPERATURE SENSORS WITH THERMOWELLS

Applicable Standard	:	ASME PTC 19.3 - Latest Revision DIN EN 60751:1996, BS EN/IEC60751:2008
Element	:	Platinum, R0=100 ohm 4-wire Duplex for Process Temp. Measurement Platinum, R0=100 ohm 3-wire Duplex for Bearing & Winding Temp. Measurement
Sheath Material/ Insulation	:	316SS/Compacted Magnesium Oxide
Sheath O D	:	8 MM
- Gauge	:	18 AWG
Terminals	:	Spring loaded high temperature ceramic base with silver plated brass for high vibrating locations.
Calibration	:	As per DIN Standard – 43760, Class A
Head	:	Hex Head, Die Cast Aluminum (Screwed) with galvanized SS chain
Response Time	:	6-10 Sec bare & 30 Sec. With protective sheath/thermowell
Accuracy	:	± 0.35 degree C or Class-A whichever is better.
Electrical connection	:	Gold plated Plug in type. Double entry – one unused entry with blind plug
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)

THERMOWELL

Applicable Standard	:	ASME PTC 19.3 TW - 2010
- Construction	:	Tapered drilled from Bar stock (Straight for Air & Gas systems)
- Material	:	- 316 SS/F11/F22/F91 - water and steam Services depending upon process parameters.



with Incoloy supporting tubes and adjustable flanges.

For Mill classifier outlet long life solid sintered tungsten carbide material or better of high abrasion resistance.

Bidder shall provide calculation for thermowell as per ASME – PTC-19.3 2010. "All Thermowells in high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safer size and design of Thermowells".

- Process Connection	:	(i) M 33 x 2 (ii) SS316 Flanged, for Air & Gas systems, with mating flanges, fasteners, gaskets etc.
- Extension	:	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
Immersion length	:	Within ± 10 mm of center line of pipe and as per ASME – PTC-19.3 - 2010
Extension neck length	:	Minimum 100 mm above insulation of pipe and Minimum 160 mm when there is no insulation on pipe.
IBR Certification	:	For high pressure service, Steam Temp., Fuel oil temp. measurement as per IBR rules and regulations
Note	:	Extension /Compensating/paired cable exposed to atmosphere in the conventional method melts away due to high temperature at the top of mill or due to coal burning. Hence The terminals of temperature sensors shall not be at the top of mills itself. The temperature sensors wires are to be laid up to JB though SS tube of required diameter and the head shall be placed nearer to the JB.

3.03.06 THERMOCOUPLES WITH THERMOWELLS

Applicable standard	:	ASME PTC 19.3- Latest Revision ANSI-MC 96.1 – 1982, IEC 584-2
Element	:	Duplex
- Sheath	:	8 MM OD
- Sheath Material	:	316 SS
- Spring Loaded	:	Yes
- Nipple/Union	:	Yes
- Packed connector	:	Compacted magnesium Oxide ungrounded



with two nipples of SS 316 having 1/2"NPT(M) threads at both ends

Thermowell : To suit Temp. switch with same design criteria as specified for RTDs.
Electrical : Suitable for Plug in type.

All the switches are internally connected and brought to the surface with Amphenol male/female connection. Cabling need not terminated inside the switch. Cable ends are to be soldered in connector and to be inserted for easy maintenance.

Other Particulars

- Capillary length : As per requirement (min 10 meters)
- Immersion Length : Within + ten (10) mm of center line of pipe with adjustable nuts.
- Extension neck length : Minimum 50 mm above insulation of pipe /As per approved hookup drawings.
- Packing glands : Yes
IBR Certification : For high pressure service, Steam Temp, Fuel oil temp. measurement as per IBR rules and regulations
N.B : Switches designed for cross ambient operation shall be used in applications where the ambient temperature will approximate or exceed the switch set point.

3.03.09 TEMPERATURE GAUGES (TG)

Applicable standard : IS : 3602,BS:5235 ISA:RP:8.1 except as modified in this specification

Type/Construction

- Thermometer : Industrial type, Gas in Filled type with separable thermowell
- Thermowell : Bar stock

Material

- Bulb : 316 SS
- Capillary : Armoured SS (Applicable for capillary Type)
- Casing : SS 316/ Die-cast aluminum with stoved enamel black finish. Epoxy coating



		shall be provided for corrosive atmosphere
Dial Size	:	150mm with shatter proof glass
Scale Details	:	270 degree dial rotation/deflection. Graduations in black lines on white dial provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges
Accuracy	:	$\pm$ One (1) percent or better
Response time	:	Maximum 15 seconds without thermowell and 30 seconds with thermowell
Connection		
- Pipe	:	M33 x 2
- Thermowell	:	To suit instrument with same design criteria specified for RTDs.
- Process Connection	:	(i) M 33 x 2 (ii) SS316 Flanged, for Air & Gas systems, with mating flanges, fasteners, gaskets etc.
- Extension	:	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
Other Particulars		
- Capillary length	:	5Meters/10 Meters as required
- Immersion Length	:	Within + ten (10) mm of center line of pipe with adjustable nuts.
- Extension neck length	:	Minimum 50 mm above insulation of pipe /As per approved hookup drawings.
- Stop at Maximum value	:	For all gauges of scale
- Pointer	:	Externally adjustable
	:	In general, Contact type Temp. gauges are not acceptable for interlock & protection.
		Contact type Temp. gauges are acceptable for interlock & protection in case of bearing temp. only.
- Over range protection	:	150 percent (%) of full scale
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
IBR Certification	:	For high pressure service, Steam



3.03.10 TEST THERMOWELLS (TW)

Applicable Standard	:	ASME PTC 19.3 TW - 2010
Type/Construction	:	Machined from Bar Stock
Material	:	316 SS/F11/F22/F91
Connection	:	
- Pipe	:	M33 x 2
- Test Instrument	:	To suit test instruments
Accessories	:	Plug with chain

Bidder shall provide calculation for thermowell as per ASME – PTC-19.3 TW - 2010.

Test wells shall be provided on main steam, reheat steam, extraction steam, feed water, condensate, spray water lines and other piping as required to meet ASME test requirements.

3.03.11 DIRECT MOUNTED LEVEL TRANSMITTERS (LT)

Displacer type level transmitter shall not be used in the process anywhere in the plant.

3.03.12 Ultrasonic Level Transmitter (for Water sump/Tank level, Raw water reservoir level, Cooling water fore bay level measurements)

Principle of Operation	:	Detection of reflected ultrasonic pulse
Measuring Ranges	:	Up to 30 meters (typical)
Signal Processing	:	Microprocessor Controlled Signal Processing
Operating Freq.	:	10 KHz to 50 KHz (typical)
Display	:	Head mounted alpha-numeric back lit LCD/LED
Calibration & Configuration	:	Accessible from front of panel & HART calibrator.
Diagnosis	:	On-line
Status	:	For power, Hi / Lo / V. Hi / V. Lo- level indication, fault etc.
Construction	:	Plug-on board
Power supply	:	240 V AC 50 Hz / 24V DC
Signal Output	:	4-20 mA DC with HART (isolated) - 600 Ohm load.
Hysteresis	:	Fully adjustable preferred
Output contacts	:	2SPDT Potential free changeover contacts @ 8A 230V AC.
Accuracy & Repeatability	:	$\pm 0.25\%$ of span or better
Resolution	:	$\pm 0.1\%$ of span
Temperature Compensation:	:	To be provided with Transducer.



Operating temp.	:	Transmitter-50 deg C and Sensor – 80 deg C
MOC Sensor	:	Body- PVDF and Face – Polyurethane
Humidity	:	1% to 95% non condensing.
Enclosure	:	IP-67 Epoxy painted die cast Aluminum or SS316L housing.
Cable Connection	:	3/4" ET
Mounting	:	2" – 4" NPT or flanged
Accessories	:	Cable gland, prefab cable, mounting accessories like EPDM seal, SS316 flanged etc.
		Additional separate local display unit with large Alphanumeric back light LCD/LED & to be provided for the applications which will be decided during detailed engineering.

3.03.13 CAPACITANCE TYPE LEVEL TRANSMITTER

The total system shall consist of capacitance probe, pre-amplifier and transmitter

Type	:	Capacitance type
Probe	:	a) Rod or suspended electrode. b) Rope type probes may be used only where required probe length is greater than 3 meters
Probe Mounting	:	Stainless steel 1-1/2 ANSI RF Flange / 3/4" NPT (M)
Material of construction	:	316 SS
Insulation	:	PTFE Part/Full as per service.
Transmitter	:	The transmitter shall receive output of the preamplifier and convert it into 4-20 mA DC output signal.
Accuracy	:	± 1% of Full scale
Repeatability	:	± 0.5 % of Full scale
Load	:	Min 600 Ohms
Enclosure	:	Powder/Epoxy coated Die cast aluminum. with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).
Ambient temperature	:	0-60 °C.
Mounting	:	Wall / Surface
Supply voltage	:	240V AC, 50Hz / 24V DC
Response time	:	100 m sec or better
Cable connection	:	3/4" ET
Accessories	:	Counter flange, Cable gland, prefab cable if any
Preferable features	:	Alarm output contacts with adjustable set point facility

3.03.14 GUIDED WAVE RADAR/RADAR LEVEL TRANSMITTER

Type	:	Guided wave Radar (Contact type)/Radar (Non contact type) as finalized by owner.
Application	:	For Turbine Lube oil tank, HFO & LDO tank level,



		Condenser Hotwell, LP heaters, CBD tank level, Stator water expansion level, and other Low pressure, Vacuum vessels.
Environment Class	:	Highly abrasive with Gases and Fumes
Orientation	:	Vertical
Probe Type	:	Flexible Single lead with chuck
Probe Material	:	SS 316L
Connection Size & Type	:	2" Flanged ANSI 300 lb SS316L material
Connection material	:	SS 316L
Accuracy	:	+/- 5 mm
Resolution	:	± 1 mm
Type (Transmitter)	:	SMART, 2 Wire
Operating Principle	:	Time Domain Reflectometry
Output	:	4-20 mA, DC with HART protocol and 600 Ω output load.
Electrical Connection	:	1/2" NPT
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
Electrical Power	:	11-42 V DC
Housing material	:	Die Cast Aluminum
Vent & Drain Plug material	:	SS
Side Flange Material	:	SS
Local Display	:	Provided (LCD Digital)
Units of Measurement	:	Length M
Electromagnetic compatibility:	:	EN-61326

3.03.15 3 D TYPE ACOUSTIC WAVE LEVEL TRANSMITTER

Type	:	Acoustic Wave Level Transmitter (3 D type)
Application	:	Coal and Ash Bunker Level, Volume & Mass.
Temperature compensation	:	Required for high temp applications
Operating Principle	:	Non - Intrusive acoustic wave transmission & Reflection
Frequency Range	:	3 – 10 KHz
Accuracy	:	+/- 0.25 % for even surface & $\pm$ 0.5% for uneven surface.
Resolution	:	1 mm
Output	:	4-20mA DC with HART
Display Unit:		
Type	:	Head mounted LCD Display with Engg. Units
Location	:	Suitable location at bunker / Silo operating floor area
Protection Class	:	IP 65 or better// flame proof (IEC-79.1, Part I) As applicable).
Material Of construction:		



Electrode assembly shall have blow out and leakage proof sealing arrangement. Field proven ceramic/zirconia probes with insulation suitable for design pressure and temperature are to be provided.

The system design shall be such that it shall ensure that failure of one probe circuit shall not affect another probe circuit and failure of any electrode will not hamper the system function and operation. Further the entire system shall be of proven fail-safe design.

The logic shall be such that the trip and alarm relay circuits shall be independent for each for Low, Low-Low, High and High-High levels of tank. Monitoring of set time for trip generation and provision of setting time delay shall be available in the system. Trip logic shall be independent and separate from faultfinding logic.

The system shall have fault diagnostic features such as process fault, system hardware fault, probe failure, circuit board failure, shorted wire etc. Further the system shall be able to distinguish between a cable fault and an electrode fault.

The necessary relays and relay modules for the Output Contacts shall be of proven design and each contact shall be rated for 5A, 240V AC/0.25A 220V DC rating. All these contacts shall be 2SPDT type. The vessel holding electrodes **shall be IBR certified**. The system shall be proven and approved by Factory mutual, USA of equivalent, IBR etc.

3.03.17

LEVEL SWITCHES (LS)

Type/Construction	:	a) External float cage type with magnetic switch actuator for tanks and vessels.
		b) Electrode/Capacitance (for oil tanks)
		c) Displacer -Top mounted for all clean water sumps.
		d) Conductivity type for high Pressure and high temperature enclosed vessel like drain pot, HP heaters etc.
Materials		
- Body	:	Cast Carbon Steel/Die cast Aluminum suitable for specified pressure and temperature ratings
	:	For corrosive liquids suitable anti-corrosive coat/lining shall be provided.
- Float/Displacer	:	316 SS
- Wire rope	:	316 SS
Differential	:	± 12 mm minimum (Adjustable)
Contacts		
- Number	:	DPDT/2 SPDT
- Type	:	Snap action micro switch Auto reset with internal Adjustable
- Rating	:	5 Amp 240V AC 0.2 Amp 220V DC
Connection - Process	:	One (1) inch SCRD NPT Female Or One (1) inch ANSI Flanged Four(4) inch ANSI Flange for sump services.
Electrical	:	Suitable for Plug in type connection



Temperature/pressure rating : As per service conditions
 Accessories : Counter flanges, still pipe of requisite length with anticorrosive coating for sump services.

Nuclear, capacitance, or ultrasonic type level switch for bulk material applications shall be provided.

3.03.17.01 Conductivity Type Level Switch

Type	:	Conductivity discrimination.
Mounting	:	Flanged – on standpipe.
Probe MOC	:	Stainless steel with high purity ceramic.
Probe rating	:	> Maximum design pressure of vessel.
Input	:	Four independent channel with selectable switching threshold for water conductivity.
Relay Output	:	Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo.
Contact type & rating	:	2SPDT or 1 DPDT @ 5A 30V DC.
Faults Detection	:	Power Fail/Electrode Connection Open circuit/short circuit to ground, Ground failure. In built Fail Safe Logic.
Indicator	:	One Red LED for steam/ one Green LED for water/ Two no. LED one each for Process & system fault.
Power supply	:	Dual 240V AC, 50 Hz, 1Ph. From UPS
Enclosure	:	IP-65, corrosion resistant & wall mounting type.
Accessories	:	i. PTFE cable from probe to electronics unit. Electronic unit shall be separate. Head mounted electronic unit is not preferred. ii. Mounting accessories iii. standpipe iv. Washer & gasket
Test pressure	:	Two times rated pressure

3.03.17.02 Capacitance Type Level Switch

Type	:	Capacitance type
Probe	:	a) Rod or suspended electrode b) Rope type probes may be used only where required probe length is greater than 3 meters.
Probe Mounting	:	Stainless steel 1-1/2 ANSI RF Flange / 3/4" NPT (M)
Material of construction	:	316 SS
Insulation	:	PTFE Part/Full as per service.



D. Application : Ash Silos

3.03.18

LEVEL INDICATORS (Gauge Glass) (LI)

Type/Construction	:	a) Reflex b) Tubular (For tanks open to atmosphere only)
Material:		
a) Glass	:	Tempered borosilicate resistant to thermal shock
b) Case	:	Carbon steel
c) Integral cocks and	:	i) Forged carbon steel with drain valves stainless steel internals ii) Rubber lined corrosion resistant 316 stainless steel (for Demineralised and Osmosis water service)
d) Fittings	:	i) Forged carbon steel ii) Rubber lined 316 steel/PVC for corrosive liquids Demineralised and Osmosis water service) iii) 304 Stainless Steel for non-corrosive liquids
e) Packing	:	Teflon
Dial size/scale	:	150 mm /1.5 Meters maximum length with
Scale details	:	Aluminum/SS316 scale Graduated in mmwc
Connection	:	25 Nb/40 Nb ANSI Flanged
Accessories	:	a) Integral cocks b) Drain valves c) Bolts, nuts and gaskets d) Illuminating lamps as required e) Periscope as required
Tests	:	Tested at two hundred (200) percent of the maximum process pressure
Other details	:	For larger lengths, additional gauge glasses shall be provided with minimum of 50 mm overlap.

3.03.19

FLOAT & BOARD TYPE LEVEL GAUGE

Type of Instrument	:	Mechanical Type (Float Operated)
Service/ Application	:	As per service requirement
Measuring Range	:	as per requirement
Material Specification		
a) Float Material	:	SS316 having 2 nos. Guide wires
b) Float Wire Pulley	:	Shall comprise of 2 nos. Cast Aluminum Pulley hosing Assembly with SS 304 pulley and pulley shaft. Steel ball bearings shall be provided in pulley housing for easier float movement. Float wire material shall be



		SS316L. Between 2 pulleys, 1" NB G.I. short pipe with tentative length as per P&ID
c) Guide wire Assembly	:	CS chamber with spring and adjuster having 1" Class 150 ANSI RF MS flange. Guide wire rope shall be SS316L.
d) Counter Weight	:	MS counter – weight with Aluminum Pointer and Brass assembly Pull Chain.
e) Scale	:	SS 316/Aluminum material in mm with 1 % accuracy.
Nozzle Details	:	For float wire pulley assembly, one tapping and for guide wire assembly two tapping at the top of the tank; Size 1" NB (Top Mounting Type)
Process Connection	:	Flanged as per ANSI B 16.5 to suit 1" NB nozzle (Nozzle length - 150 mm for float wire, 100 mm for guide wire)
Accessories (to be supplied with the instrument)		
a) Counter flange	:	All mating Flanges, Nozzle
b) Mounting Accessories	:	All mounting accessories
c) Tag Plate	:	To be provided (material SS316)

3.03.20**MASS FLOW METER****Sensor**

Measuring Principle	:	Coriolis Mass flow.
Primary Element	:	Flow Tube of 316SS or better
Heating Arrangement	:	Integral with Flow meter.
Temperature Control For Heating	:	To be provided.
Process Connection	:	ANSI RF Flanged and rating as per process requirement.
Drain	:	Self-draining facility
Accessories	:	Counter flanges, Mounting nuts, bolts, gaskets etc.

Transmitter

Measured quantities	:	Mass Flow rate, Total Mass Flow, Density, Temperature as minimum.
Input Signal Processing	:	Digital Processing.
Display	:	Digital Display (LCD).
Output	:	2 Nos. isolated output of 4-20mA DC selectable from four measured quantities.
Load	:	< 750 ohms.
Power supply	:	240V AC, 50 Hz. From UPS
Accuracy	:	0.15% of measured value for Liquid 0.5% of measured value for Gas
Repeatability	:	0.05%
Housing	:	IP 65 (Explosion proof for NEC Class-1, Division 1 area)
Hazardous duty Version	:	FM Standards.



Output Signal	:	Pulse
Material of Construction	:	AISI 316
Sensor Seal	:	PTFE / higher based on temperature
Flow range	:	As required.
Linearity	:	0.25% or better.
Repeatability	:	0.02% or better.
Ambient temperature	:	50 deg C
Mounting	:	On-Line mounting with flanges of stainless steel.
Enclosure	:	IP 65
Accessories	:	Nuts, bolts, gaskets etc.
Transmitter		
Electronics	:	Solid State
Power Supply	:	240V AC, 50Hz. UPS
Input	:	Input from Sensor
Display	:	4 1/2 digit LCD
Output	:	Isolated 4-20mA DC HART
Measuring Accuracy	:	0.5% of full scale range
Totalized Value	:	Required
Housing	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
Nameplate	:	Tag number, service engraved in stainless steel tag plate
Accessories	:	Clamping strip, bracket, prefab cable etc. Special tool kit for calibration/ configuration .

3.03.23

Flow Transmitter (Ultrasonic)

Type	:	ULTRA SONIC, 2-wired
Sensing element	:	Non-contact
Output	:	4-20mA with HART Protocol
Accuracy	:	± 0.1% FS
Supply	:	24 V DC
Enclosure class	:	IP-65
Transmitter		
Mounting	:	On Nozzle
Mounting position	:	Top mounted
Housing	:	Plastic
Display	:	Head mounted LCD Display and remote LCD display
Process connection	:	NPT/Flanged
Electrical connection :	:	NPT
Turn Down ratio	:	1:100
Measuring range	:	Adjustable (as per process requirement)
Totaliser	:	Required
Accessories	:	As per process requirement Additional separate local display unit with large Alphanumeric back light LCD/LED & to be provided for the applications which will be decided during



- b) Nuts, bolts, gaskets, mesh etc.
Special tool kit for calibration/configuration.

3.03.25 Electromagnetic Flow meter

Electromagnetic flow meters shall have separate transmitter having accuracy $\pm 0.2\%$ with zero stability feature, suitable for process medium with ≤ 5 micron Siemens conductivity, flanges material SS-316, electrode & measuring tube material SS-316, liner material Teflon and enclosure IP-66, local digital display configurable as totaliser, 4-20 mA output signal HART compatible with zero and span field adjustable. Application – DM Water and for other application as decided by owner.

3.03.26 FLOW GAUGES (FG)

- | | | |
|-------------------|---|---|
| Type/Construction | : | a) On-line type Rotameter for 50 Nb and below lines |
| | : | b) Bypass type Rotameter for above 50 Nb lines. |

Material

- For On-line type

- | | | |
|---------------|---|--------------------|
| Metering Tube | : | Borosilicate glass |
| Float | : | 316 SS |
| Packing | : | Teflon |
| End fittings | : | 304 SS |

-For Bypass type

- | | | |
|--------------------------|---|---|
| Metering Tube | : | Borosilicate glass |
| Float | : | 316 SS |
| Packing | : | Teflon |
| End Fittings | : | 304 SS |
| Orifice Plate | : | 316 SS |
| Carrier ring | : | 304 SS |
| Flanges & Mating flanges | : | Same as pipe material, 200 lbs ANSI - RF |
| Impulse pipe | : | Same as pipe material |
| Fittings | : | 2000 ANSI, SW ends to match with pipe material. |
| Dial Size/Scale length | : | 250 mm |
| Scale Details | : | Direct reading type engraved on detachable Aluminum scale |
| Accuracy | : | $\pm$ Two (2) percent |
| Reproducibility | : | Half (1/2) percent |
| Rangeability | : | 1:10 |
| Connection | : | SCRD NPT |



Accessories	:	a) Isolating valves (for Bypass type only)
		b) Bolts, Nuts and Gaskets as required
Tests	:	Shall be tested at two hundred (200) percent of the maximum process pressure

3.03.27 SIGHT FLOW GLASS INDICATORS

Type/Construction	:	Flapper type.
Materials	:	
Body	:	Carbon steel/SS316 as per process requirement
Glass	:	Toughened Borosilicate
Gaskets	:	Neoprene
Bolts & nuts	:	SS
Flappers / Rotating Wheel	:	316 SS
Flappers / Rotating Wheel holder	:	304 SS
Process Connection	:	SW (Socket Welded)
Accessories	:	Scale, Bolts, Nuts, Cover plates and Gaskets as required
Tests	:	Tested at two hundred (200) percent of the maximum process pressure.

3.03.28 SOLID FLOWMETER

Type	:	Online Impact type Microprocessor Based
Measuring Principle	:	The system measurement is basically pertains to the measurement of horizontal deflection using LVDT, created by the impact of solid flow upon online sensing plate. The horizontal deflection being proportional to the impact forces, LVDT convert this horizontal movement into electrical signal. The inbuilt integrator convert this signal into time based flow rate indication & provide totalized flow also.
Sensing plate	:	316 SS
Sensing head	:	Sensing mechanism shall be mounted outside the process flow line.
Enclosure	:	316 SS
Enclosure protection	:	IP 67 class
Accuracy	:	+/-1%
Repeatability	:	+/- 0.2%
Drift	:	Both zero & span $\pm$ 2% / month
Output	:	4-20mA DC isolated, load 600 ohm (min)
Digital communication	:	yes, (HART) facility
Power supply	:	240 V AC, 50Hz. UPS
Ambient condition	:	Temperature -60 ^o C, RH-95% Environment – Highly Dusty



Accessories : Shall be complete with all the accessories including digital display for flow rate, integral vents, baffles for air separation, etc. which ever required for satisfactory operation.

Note:-

1. The above on line flow meter shall not create any obstruction on flow.
2. User's list shall be submitted to support on proven satisfactory performance for similar process application.

3.03.29

Instrument Air System

The instrument Air Supply System for various pneumatic Control & Instrumentation devices like pneumatic actuators, power cylinders, I/P converters, pneumatically operated valves etc. shall be complete in all respect with necessary Air Filter Regulators, valves, piping/tubing etc.. Each pneumatic instrument shall have an individual air shut off valve. The pressure-regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built in filter-housing blow down valve.

Filter shall be of minimum 5-micron size & sintered bronze material.

On collection of water in the drains of instrument air lines, mechanical automatic drains and periodically solenoid operated drains (with electronic timer - 15m, 30m, 60m and 2 Hours & Timing adjustable) are to be provided.

For mechanical type & Electrical type, the locations to be provided in the instrument air lines of boiler area, Chimney area, turbine area etc., shall be decided during detailed Engineering.

Bulk header nearby the crowded applications shall be provided and from this bulk header individual air lines with necessary isolation valves are laid to the application.

These bulk header are to be provided with **mechanical / electronic based automatic Drains**.

Individual moisture separator for O₂ analyzer or vital application shall be provided nearby the instrument so as to enhance the cell life or the performance of vital final control elements.

3.03.30

Air Filter Regulator (AFR)

Constant bleed type AFR with an accuracy of ± 1.0 % inlet pressure range of 5-8 kg/ cm² and suitable spring ranges (AFR) for use with positioners in control valves, control damper, E/P converters and shut off valves for phosphor bronze filter element; Filtering particles above five microns. Weather and water proof enclosure. Material of accessories will be SS316.

Air filter regulators shall be provided in the :

- (a) Air supply line to valve positioners / power cylinders
- (b) Air supply line to electric to pneumatic converters.



- (c) Air supply line to pneumatic interlocked block valves.
- (d) For each instrument rack, field instruments enclosure for purging.

3.03.31 Electro-Pneumatic Convertors (E/P)

Two wire type E/P convertors with an accuracy of $\pm 0.25\%$ accepting 4-20 mA dc signals from control system and converting to 0.2 to 1 kg/cm² air pressure to operate valve positioner of all final control elements; Housed in cast aluminum casing (with polyurethane paint); NEMA 4 or equivalent degree of protection for enclosure. Material of accessories will be SS. E/P convertors shall have fail freeze (stay put) feature also. Process connection shall be 1/4" NPT (F) and Electrical connection shall be 1/2" NPT (F). Zero/span adjustment facility shall be provided. The E to P convertors shall **retain the pneumatic signal (last value) even in failure of control signal** and shall have **self volume boosters**. Necessary air lock devices and pressure switches for air pressure low alarming shall be provided.

3.03.32 Solenoid Valves

Solenoid valves shall be provided with control valves / pneumatic control valves hooked up with process interlock requirements and where direct tripping is involved. The number of ways for solenoid valve shall be provided as indicated below:

- (a) Two (2) way solenoid valves shall be provided, where process line of less than 50 mm with low pressure and temperature application.
- (b) Three (3) way solenoid valve shall be provided commonly, where the pressure is admitted or exhausted from a diaphragm valve or single acting cylinder, e.g, Pneumatic operated spray water block valve.
- (c) Four (4) way solenoid valve shall be provided for operating double acting cylinders, e.g, Pneumatically operated on-off type dampers.
- (d) For operation of the fuel oil corner nozzle valves, fuel oil trip valves etc., **double coil solenoid valve** (latch coil & relatch coil) shall be adopted.
Single coil usage requires always power and loss of power leads to closure of above valves resulting the unit trip or loss of generation.
- (e) Solenoid Valve coils shall be Class-H high-temperature or Class-F construction as applicable and shall be designed for continuous duty. Three-way solenoid valves shall be designed for universal operation so that the supply air may be connected to any port. Solenoid enclosures shall be NEMA-4)/ (Explosion proof for NEC Class-1, Division 1 area)/ flame proof (IEC-79.1, Part I) As applicable). Body material of solenoid valve shall be Die Cast Aluminum or SS316.
- (f) All solenoid shall be with varister, LED indication, surge suppress diode and circuits.



- Failure Diagnostics
- Long Term Stability
- Fast Response
- IP 66 / NEMA4X Protection
- Supplied with Calibration Certificate Traceable to National & International Humidity Standards
- Sensor protection with sintered filter
- Local LCD Display for Dew Point

3.03.42

Junction Boxes

- | | | | |
|-------|---|---|--|
| v. | Type | : | Flame proof/weather proof |
| vi. | Enclosure | : | IP-65/Explosion/Flame Proof as per area classification. |
| vii. | Material | : | FRP with protective Coating |
| viii. | Cable entry | : | Bottom or Side |
| ix. | Cable glands | : | Double compression type – Nickel plated brass with PVC hoods. |
| x. | Mounting | : | Indoor/Outdoor |
| xi. | No. of terminals | : | As required with standardization with 20% spare of each size & type. |
| xii. | Terminals | : | Phoenix/Wago (screw less cage clamp type spring loaded) |
| xiii. | Grounding | : | Two terminals for body and shield ground |
| xiv. | Door | : | Hinged, lockable type. |
| xi. | Suitable mounting clamps and other accessories shall be in scope of bidder. | | |
| xii | The brackets, bolts, nuts, screws, glands, lugs required for erection shall be of brass, included in bidder scope of supply. High voltage & insulation resistance test shall also be conducted. | | |
| Xiii | M6 Ni plated Brass earthing stud shall be provided (external 2 nos. internal 1 no.) | | |
| xiv | Gasket (Normal)- Neoprene thickness 6.0 mm | | |

3.03.43

Interposing Relays (IPR)

Electro magnetic type IPRs with modular design, plug-in type connections, suitable for channel/DIN rail mounting in cabinets; coil rating 24V D.C; 2 set of silver plated change over contacts rated for 0.5A 220 V DC/8 A 240 V AC. Free wheeling diode across relay copper coil and self reset type status LED indicator flag (electronic) shall be provided. Manual forcing/override facility is required. The test voltage for relay shall not be less than 4 KV with operating temperature from –20 deg. C to 60 deg. C. The relay shall have the necessary approvals like V0 inflammability class in accordance with UL94”, IEC60664/IEC60664A/DIN VDE 0110. Facility to stimulate IPR manually shall be provided. The VA burden of relays shall be suitable to match the capacity of output modules. Interposing relay & sockets for mounting the interposing relay shall be of same make only.

~~3.03.44~~~~**RECORDERS (CHARTLESS)**~~

- | | | |
|-------------------|---|--------------------------------|
| Type | : | Micro-processor based, Digital |
| | : | TFT display type |
| - No. of Channels | : | Forty Eight (48) point). |



Input	:	110 V PT Volts
Output	:	4-20 mA with 500 impedance
Mounting	:	Back rail
Accuracy	:	$\pm 0.25\%$

3.03.57 TRANSDUCERS FOR POWER FACTOR

Input	:	PT (110V)
Output	:	4-20 mA with 500 impedance
Mounting	:	Back rail
Accuracy	:	$\pm 0.25\%$

3.03.58 TRANSDUCERS FOR MVAR

Input	:	CT & PT (110V/1A)
Output	:	4-20 mA with 500 impedance
Mounting	:	Back rail
Accuracy	:	$\pm 0.25\%$

3.03.59 DIFFERENTIAL FREQUENCY TRANSDUCERS (FOR SYNCHRONIZATION)

Input	:	110 V PT
Output	:	4-20 mA with 500 impedance
Mounting	:	Back rail
Accuracy	:	$\pm 0.25\%$

3.03.60 DIFFERENTIAL VOLT TRANSDUCERS (FOR SYNCHRONIZATION)

Input	:	System voltage
Output	:	4-20 mA with 500 impedance
Mounting	:	Back rail
Accuracy	:	$\pm 0.25\%$

3.03.61 PUSH BUTTONS (PB)/ ILPBs FOR ON/OFF, OPEN/CLOSE, START/STOP

Type	:	Momentary/Miniaturised Suitable for mosaic grid 24x48 Mm with 2 PB and 3 coloured LED.
------	---	--

Contact Configuration	:	2 NO + 2 NC
Contact Material	:	Hard Silver Alloy
Contact Rating	:	500V / 10 A
Insulation Voltage terminals and earth	:	2 KV for 1 minute between

Lamp Rating :-

a) Voltage	:	240 V AC
b) Watt	:	2 Watt (approx.)

Colour



Red	– ON/Start/Open ILPB
Green	– OFF/Stop/Close ILPB
Red	- energized, running, Start, valve open LED/Lamp
Green	- de-energized, stopped, valve closed LED/Lamp
Light yellow	- abnormal, discrepancy LED/Lamp
Red	– OFF/Stop/Close PB
Green	– ON/Start/Open PB
Red	- Emergency trip push buttons with red flap / hinged Transperent arylc cover.

3.03.62	PUSH BUTTON FOR Control DESK:	Momentary mosaic grid mounted 24x48 mm size, single PB 18x40 mm Colours for DESK RELEASE - Yellow, Desk Lamp test - Blue, Desk Ack - Green
3.03.63	PUSH BUTTON FOR SEQUENCE START/RELEASE	: Momentary (Miniaturised) suitable for mosaic grid 24x48 mm 3 PB + 5 LED
3.03.64	PUSH BUTTON FOR ANNUNCIATION	
	Contacts	
	- Number & Type	: As per requirement
	- Breaking capacity	: 1 Amp, 220V DC 10 Amp, 600V AC Different colours for Accept/Ack - Green, reset Grey, Lamp test – Blue, System Test – Yellow & Audio Ack - Black.

3.03.65	<u>BELT WEIGHING SYSTEM</u>
3.03.65.1	General
	The mechanical design and constructional features for belt weigher has been described under mechanical section, hence not repeated here, Similarly motor specifications for the same has been covered under electrical specification, hence not repeated here.
	The belt weighing system shall have its own local control panel to be located in electrical equipment room. The local panel shall include: (a) Local flow rate indication (b) Integrated flow rate indications (c) System alarm annunciation (d) Local Calibration facility (e) Power on/off All these above display shall be backlit LCD type with 12mm character height. NI Cd Battery back up (60 minutes backup) shall be provided for the measurement system. (a)Application : Bulk material, Powder material (b)Drive Protection : Reverse Polarity, Communication failure



5.12.00 Technical Specification of pH Cell and Transmitters

- | | | |
|----|--------------------------------------|--|
| a) | Applicable Standard | pH electrodes shall conform to IS: 6804-1972 except as modified in this specification |
| b) | Type: | |
| | i) Cell | Measuring and Reference Electrode Combination with Flow through type (SS316/Polypropylene flow chambers) for power plant's steam & water application. Sensor shall not be affected by flow variation. Sensor shall be designed for power plant applications. |
| | ii) Monitors | Electronic (microprocessor based) indicating type with adjustable range facility. |
| c) | Material: | |
| | i) Measuring & reference | Toughened sensitive |
| | ii) Electrode | pH glass |
| | iii) Monitor body | Carbon steel/Aluminum/Polycarbonate |
| d) | Monitor output | |
| | i) | 4-20 mAmp D.C. with HART protocol spare out put |
| | ii) | 4-20mA DC with HART protocol for DDCMIS
Output load : 500Ω |
| e) | Power supply | 240V AC, 50 Hz from UPS |
| f) | Accuracy/repeatability | + 0.03 pH/+0.02PH |
| g) | Resolution | + 0.01 pH or 1 mV. 1C |
| h) | Stability | 0.02 pH per week |
| i) | Annunciation contacts from monitors: | |



- | | | | |
|----|-------------|---|--|
| | i) | Number | 2 SPDT 'Hi' and 'Lo' |
| | ii) | Type | Snap action micro switch |
| | iii) | Rating | 5 amp, 240V AC, 0.2 Amp, 220V DC |
| j) | Connection: | | |
| | i) | Process | One-quarter (1/4)inch NPT(F) SCRD
ON-LINE |
| | ii) | Electrical | Half (1/2) inch NPT(F) SCRD |
| k) | Mounting: | | |
| | i) | Cell | Pipe Mounted |
| | ii) | Monitors | Flush panel mounting |
| l) | Accessories | | |
| | i) | Automatic temperature compensation with fast response integral temperature sensors in the range 0-100°C | |
| | ii) | Co-axial cable as required | |
| | iii) | Sample coolers | |
| | iv) | low and pressure regulators | |
| | v) | Standard pH solutions | |
| | vi) | SS316 impulse tubing and fittings | |
| | vii) | Isolation & drain valves as required | |
| | viii) | Electrode holders | |
| | ix) | Other accessories as required | |
| | x) | Sample rate set valves | |
| | xi) | Alarm settings and indications on monitor. | |
| | xii) | RFI/EMI shielded, weather and corrosion proof casing | |



Pre Amplifier : Built-In

TRANSMITTER

Type : Microprocessor Based
Transmitter Output : 4-20 mA DC
Enclosure Protection : IP65
Enclosure material : polycarbonate
Electrical connection : ½" NPT (F)
Local Indicator : Provided (LCD Display)
Accuracy : 0.2 NTU or ± 2% of reading
Repeatability : ± 0.1% of span
Temp. compensator : built-in
Cable between transmitter & sensor : To be provided

5.22.00 All analysers shall be supplied with chemicals/regents required for 12 months operation.
Bidder shall also provide start up kits, buffer solution for pH and conductivity analyzer.
The analyser supplier shall submit the preparation procedure / formula of the reagent to be used in analyser solution.



5.19.00 Technical Specification of Chlorine Analyzer

- | | | |
|------|------------------------|---|
| i) | Type | Microprocessor based Continuous flow through sample type with automatic temperature compensation. |
| ii) | Analyzer power supply | 240V AC, 50 Hz, Single Phase from UPS |
| iii) | Analyzer output | i) 4-20 mA, DC spare output
ii) 4-20 mA, DC isolated output for DDCMIS |
| iv) | Accuracy | 0.005 mg/ltr. or 1% of range. |
| v) | Sensitivity | 0.001 mg/ltr. (1 ppb) |
| vi) | Range | As per schedule. |
| vii) | Annunciation contacts: | |
| - | Number | As per schedule, 2 SPDT |



	-	Type	Snap action micro switch
	-	Rating	5A, 240V AC, 0.2A, 220V DC
	-	Mounting	Flush
viii)		Terminal points	All components piped & wired to terminal points
ix)		Accessories	i) Flow regulator ii) Flow gauges iii) Sample rate set valves iv) Other accessories as required to make the system complete

5.20.00 Technical Specification of Residual Chlorine Analyser

SENSOR

Method	:	Amperometric
Electrodes	:	Gold Cathode/Silver Anode
Cell Material	:	PVC
Electrolyte	:	Potassium Bromide

TRANSMITTER

Type	:	Microprocessor Based with self diagnostic features
Transmitter Output	:	4 – 20 mA
Enclosure Protection	:	IP65
Enclosure Material	:	Polyester coated Al.
Electrical Connection	:	½" NPT (F)
Mounting	:	FIELD
Display Type	:	LCD
Display Details	:	4 digit backlit LCD matrix
Diagnostics	:	Required
Meter Range	:	0-1 mg/l
Resolution	:	0.01 ppm
Area Classification	:	SAFE
Electromagnetic Compatibility	:	BUILT – IN
Temp. Compensator	:	AUTO – BUILT – IN
Temp. Compensating element	:	PT100

5.21.00 Technical Specification of Turbidity Analyser

SENSOR

Reference type	:	On Line
Operating principle	:	Alternating Light Source
Cleaning	:	Self Cleaning
Electrode holder – type	:	Flow Through
Body Material	:	CPVC
Process Connection	:	½" NPT (F)



Pre Amplifier : Built-In

TRANSMITTER

Type : Microprocessor Based
Transmitter Output : 4-20 mA DC
Enclosure Protection : IP65
Enclosure material : polycarbonate
Electrical connection : ½" NPT (F)
Local Indicator : Provided (LCD Display)
Accuracy : 0.2 NTU or ± 2% of reading
Repeatability : ± 0.1% of span
Temp. compensator : built-in
Cable between transmitter & sensor : To be provided

5.22.00 All analysers shall be supplied with chemicals/regents required for 12 months operation.
Bidder shall also provide start up kits, buffer solution for pH and conductivity analyzer.
The analyser supplier shall submit the preparation procedure / formula of the reagent to be used in analyser solution.



CHAPTER-12**FLOW ELEMENTS**

12.00.00 This specification covers the design, material, construction features, manufacture, inspection and testing at the VENDOR'S/SUB-VENDOR'S WORKS and delivery to site of Flow Elements.

The equipment furnished to this specification shall conform exactly to the requirements herein, unless modified by the respective Data Sheet of the equipment.

12.01.00 The design, material, construction features, manufacture, inspection and testing of flow elements shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable standards. Nothing in this specification shall be construed to relieve the Bidder of this responsibility.

12.02.00 Technical Requirement

316SS long radius, weld in flow nozzles with D and D/2 pressure tapings; 316SS flow orifice plate assembly with flange tap connections; β ratio of 0.4 to 0.7. Element material of SS 316. The material of Flow nozzle shall be A182F91, where pipe material is A335P91. The material of all type of accessories will be SS316. End connections for flow elements will be butt welded except orifice plate on condensate return line to CST, which will be flanged. The accuracy of the flow element shall be $\pm 0.5\%$ or better.

Standards

The flow elements (Orifice plates) shall be designed in accordance with ASME PTC – 19.5 (Pt – II), ISA RP3.2, 1960 or BS 1042/ISO 5167.

The flow elements (Flow Nozzles) shall be designed in accordance with ASME PTC – 19.5 (Pt – II), or BS 1042/ISO 5167.

Construction and installation of flow nozzles and orifices shall conform to the requirements of ASME Performance Test Code PTC-19.5 as mentioned above and discharge coefficients shall be predicted in accordance with data published in ASME Research Report on Fluid Meters.

Flow nozzles shall be provided for critical measurements where weld-in construction is required. Flow nozzles shall be made with quater, triple or dual sets of pressure taps installed in the pipe wall where required considering spare one set of pressure tap. Installation of flow nozzles and pressure taps shall be made in the pipe fabricator's shop.

Anubars shall be used where pressure loss is critical and/or conditions permit their reliable installation.

Concentric orifice plates shall only be provided for other flow measurements where flanged construction and higher pressure losses are acceptable. Orifice plates shall be



made of stainless steel. Orifice flanges shall be of the raised face weld neck type with dual sets of taps. Thickness of Orifice plate shall be 3 mm for pipe diameter up to 300 mm and 6 mm for pipe diameter above 300 mm.

Coriolis principle based mass flow meters shall be used for flow (mass & volume) measurement of liquid fuel.

Aerofoil/ Venturi tubes shall be provided for Air flow measurement.

Flow element shall be accompanied by IBR certification. Hydraulic test pressure shall be considered 1.5 times of design pressure at normal temperature.

SS nameplate to flow elements shall include Tag no/ KKS No./Sl. No./ Body Material/Beta ratio/line size & thickness/ direction of flow.

BIDDER to ensure that maximum pressure drop/loss shall be limited to 30% of Differential Pressure for flow Nozzle & 60% of DP for Orifice plate.



12.05.00 PERFORMANCE

The Bidder shall submit type test certificate from a recognized test house certifying evaluation of construction standard, accuracy of calibration.

12.06.00 TESTS AND INSPECTION

All equipment components shall be individually tested to ensure correct functioning. Following tests shall also be conducted:

- a) Calibration test
- b) Dimensional check
- c) Material test

Wet calibration shall be carried out as on each size and design of flow element as per ASME PTC or BS 1042/ISO 5167. The other tests shall conform to ASME-PTC 19.5. The Bidder shall submit the reports for all the tests carried out for Owner's review and records. The functional test shall also be witnessed by owner as per approved QAP.



CHAPTER-11**CONTROL VALVES WITH ACTUATORS****11.00.00 CONTROL VALVES, ACTUATORS AND ACCESSORIES****11.01.00 GENERAL REQUIREMENTS**

11.01.01 This section covers the design and construction requirements of Control Valves, their Actuators and Accessories. Except as otherwise specified herein, the Control Valves and accessory equipment furnished under this specification shall be designed, constructed and tested in accordance with the latest applicable requirements of code for Pressure Piping ANSI B31.1, the ASME Boiler and pressure vessel code, Indian Boiler Regulation (IBR) and other standards referenced herein as well as in accordance with all applicable requirements of the "Federal Occupational Safety and Health Standards, USA", or acceptable equal standards.

11.01.02 The design of Control Valves shall comply with relevant codes and standards, account for relevant design criteria viz. environmental conditions, power and air supply, established reliability (reliability target and life expectancy), design of enclosures as specified in Sections earlier.

11.01.03 All Control Valves and accessories furnished under the Section shall be of Owner approved make, fully meeting the qualifying requirements.

11.01.04 Each control valve station shall be provided with pneumatic bypass control valve or Inching type motorised bypass valve as per process requirement and subject to owner approval. In addition each control valve shall also have upstream motorised valve. Downstream motorised valve shall also be provided as per process requirement and as finalized during detailed engineering.

11.02.00 CONTROL VALVE CONSTRUCTION AND SIZING**11.02.01 General**

1. Valve Construction shall be in accordance with the requirements specified herein. (Bidder to also refer NIT drawing # 114-18-0100).
2. The design of all valve bodies shall conform to the requirements of ANSI (USA) for dimensions, material thickness and material specification for their respective pressure classes.
3. The valve sizing shall be suitable for obtaining maximum operating conditions with valve opening at approximately 80% of total travel. Valves shall be open not less than 15 % of full opening for minimum flow condition and shall be capable of handling at least 120% of the required maximum flow at full open condition. Actual pressure drop is indicated in the specification sheets. Permissible pressure drop shall be calculated and



used by the Bidder for sizing calculations. Valve sizing shall be in compliance with the latest edition of ISA Handbook on control valves, ISA standards "ANSI/ISA-75.01.01, Flow Equations for Sizing of Control Valves" with due consideration for the measures to avoid choked flow. Bidder shall ensure that the valve outlet velocity does not exceed 8 meters/second for liquid services, 150 m/second for steam services and 50% of sonic velocity for flashing services by selecting proper body size for the required Cv.

4. a. The Bidder shall provide valves designed to prevent cavitations, wire drawing, flashing on the downstream side of valve and in downstream piping, when operating through full range under the specified conditions.

For cavitating services, valves with anti cavitation trims shall be offered. This shall ensure cavitation prevention by multiple stages of pressure drops. Detailed calculations shall be furnished by bidder to establish cavitations occurrence or otherwise for various process conditions each service wise.

For flashing services such as heater drains, control valve design shall be specially effected to ensure suitability for the adverse high pressure drops and minimise its detrimental effects on control valve parts.

Bidder shall furnish detailed catalogue, calculations, write ups to establish compliance to these stipulations with the selection of each valve. No price implications during engineering stage would be admissible to comply with these stipulations and intents of specification.

- b. The Liquid pressure recovery factor (FL) shall be 0.995 or better for severe flashing/cavitation services.
 - c. The Liquid pressure recovery factor (FL) shall be 0.985 or better for low flashing/cavitation services.
5. Each valve shall be designed for tight shut-off against pressure, the valves shall have maximum permissible leakage rate as per ISA RP 39.6 Leakage Class IV (0.01% of rated valve capacity) or specified other wise.

Control Valves for Application such as HP/LP heaters emergency level control, SH spray & RH Spray control, Emergency makeup to Hotwell, Deaerator drain to condenser hotwell & heavy oil heating, HFO & LDO and Pressurizing control system, condenser normal make up control valve shall have permissible leakage rate as per leakage class V (ANSI/FCI).

All SH/RH block valves, shut off valve of LDO & HFO and BFP recirculation valve shall have leakage class MSS-SP-61.



6. The valve design shall take into account noise abatement considerations. The design objective will be to limit the generation of valve induced noise to 85 dBA at 1 Meter from the valve surface under actual operating conditions. The noise abatement shall be obtained by valve body and trim design and piping arrangement and not by the use of silencers.
7. The Bidder shall be responsible for proper sizing of the valve and selection of appropriate model and materials of constructions for meeting the operating requirements specified herein and details subsequently furnished during the detailed engineering stage.
8. The valve travel time shall be less than 10 second for non critical services valves.
9. Rangeability should be 50 to 1 (min.) for non critical services valves.
10. Control Valve's Linearity, Hysteresis, Accuracy shall be $\leq \pm 1\%$ and Sensitivity shall be $\leq \pm 0.5\%$.

Bidder shall furnish the Control Valve data sheets and sizing calculations with the proposal which will be subjected to owner approval during detailed engineering. The bidder shall furnish all valves as per Owner approved data sheets and drawings.

11.02.02 **Valve Construction**

1. All valves shall be of globe body design and straightway pattern. Straightway pattern valves shall be either single or double ported as specified. Double ported and single ported valves shall have high lift cage guided plugs, unless otherwise specified.
2. Where specified, valves with cage guided plugs and quick change trim shall be supplied. The quick change trim shall consist of a cage and seat ring clamped in the valve body by the valve bonnet and sealed with a spiral wound stainless steel asbestos gasket. The trim shall be removable through the top after bonnet removal without any cutting or welding of the valve. Where applicable, plugs shall be designed to include pressure balancing for cage guided valves.
3. Direct acting and self-contained pilot type valves may have low lift plugs.
4. Cast iron valves are not acceptable.
5. Bonnet joints for all control valves shall be of the flanged and bolted type or other construction acceptable to the Owner. Bonnet joints shall be designed for easy disassembly and for assurance of correct valve stem alignment. Bonnet joints of the internal threaded or union type will not be acceptable.
6. Plugs shall be of one-piece construction either cast, forged, or machined from solid bar stock. Plugs shall be screwed and pinned to valve stems or shall be integral with the valve stems.



7. When Teflon packing is used, the lower valve stem which passes through the stuffing box shall be polished to at least 2×10^{-4} millimeters r.m.s.
8. Valves gland packing shall normally be Teflon on liquid and gas services up to 100 kg/cm^2 and 230°C . Teflon impregnated asbestos shall be used above 230°C and graphite impregnated asbestos with lubrication shall be used for steam services.
9. All valves shall be arranged so that the plugs may be removed from the valve bodies from the bonnet side.
10. Each valve shall have an arrow permanently fixed on the valve body to indicate the correct direction of flow.
11. Each valve shall have a stainless steel name plate permanently fastened to the yoke which shall be visible when the valve is in service. The name plate shall include
 - a. Tag No. and Valve Serial No.
 - b. Body material, size and pressure rating
 - c. Trim material, size characteristics
 - d. Action on air failure
 - e. Spring range
 - f. Stem travel
 - g. Valve action, etc.

11.02.03

Valve Materials

1. Valve material shall be as specified in Supplier's approved Control Valve Specification sheets. The following table defines abbreviations used for valve materials:

S.No.	Abbreviations	Description
a	BR	Bronze ASTM B 61
b	CS	Carbon Steel Forged - ASTM A 105 Cast - ASTM A 216 Grade WCC
c	1- ¼ CR	1-1/4 % Chromium Alloy Steel Forged – ASTM A 182 Grade F11 Cast – ASTM A 217 Grade WC6
d	2- ¼ CR	2-1/4 % Chromium Alloy Steel Forged – ASTM A 182 Grade F22 Cast – ASTM A 217 Grade WC9
e	5 CR	5% Chromium Alloy Steel Forged – ASTM A 182 Grade



		F5 Cast – ASTM A 217 Grade C5
f.	SS	Stainless Steel AISI Type 316 ASTMA 351 Grade CF8M

2. Body material shall be selected by the Bidder to be compatible with the nature of the fluid, service conditions, and piping material to which it is welded and shall be subjected to Owner approval. In general, cast or forged carbon steel bodies shall be provided for non-corrosive process applications up to 275 Deg.C. Alloy Steel castings shall be provided when the media is non-corrosive and the temperature exceeds 275 Deg.C and is within 550 Deg.C. Stainless Steel of suitable grade shall be provided when media is corrosive and the temperature is below 300 Deg.C.

Sr. No.	Service	Body Material
1.	Non Corrosive, Non Flashing, and non cavitations service for process temp. up to 275 deg. C like Aux. steam flow to Deaerator, Cond. Flow to deaerator, Fuel Oil, Atomising steam service etc.	Cast Carbon Steel ASTM A216 Gr. WCB/WCC
2.	Non Corrosive, Non Flashing, and non cavitations service for process temp. above 275 deg. C. and up to 550 deg. C. and for CRH flow to Deaerator.	Cast Alloy Steel ASTM A217 Gr. WC9
3.	Severe Flashing/ cavitations service like Feed Control Valve, Spray Control valves, LP/HP heater emergency level control valve, HP BP spray control valve, Deaerator Overflow control valve etc.	Cast Alloy Steel ASTM A217 Gr. WC9
4.	Low Flashing/ cavitations service like LP/HP heater normal level control & Condensate/feed water below 275 deg. C.	Cast Alloy Steel ASTM A217 Gr. WC6
5.	DM Water Application (Condenser Hotwell normal & Emergency make up etc.)	Cast type 316 Stainless Steel ASTM A351 Gr. CF8M

3. Unless otherwise specified, all control valves shall have stems, guide bushings, plugs, seat rings, stem lock pins, stuffing box parts, and other trim, all made of stainless steel. Valve guide posts and bushings shall be stellite faced for valves where specified. Stellite faced guide posts and bushings shall be differential hardened. For applications involving high pressure drop as also for flashing and cavitation services, trim material shall be properly chosen to ensure required degree of hard facing (such as 17-4 PH SS) so as to avoid erosion.

Sr. No.	Service	Trim Material
1.	Non Corrosive, Non Flashing, and non cavitations service for process temp. up to 275 deg. C. like Aux. steam flow to Deaerator, Cond. Flow to deaerator, Fuel Oil, Atomising steam service etc.	SS316 Stellite
2.	Non Corrosive, Non Flashing, and non cavitations service for process temp. above 275 deg. C. and up	SS316 Stellite



	to 550 deg. C. and for CRH flow to Deaerator.	
3.	Severe Flashing/ cavitations service like Feed Control Valve, Spray Control valves, LP/HP heater emergency level control valve, HP BP spray control valve, Deaerator Overflow control valve etc.	440 SS
4.	Low Flashing/ cavitations service like LP/HP heater normal level control & Condensate/feed water below 275 deg. C.	17-4 PH SS
5.	DM Water Application (Condenser Hotwell normal & Emergency make up etc.)	17-4 PH SS

4. Where stellite facing is not specified, hardened stainless steel shall be furnished for all surfaces subject to wear.
5. Manufacturer recommended materials for cage guided valves may be substituted for materials specified provided they satisfy the specified service conditions. Also where substitutions are made, the manufacturer shall guarantee performance of recommended materials to be equal to or better than the specified materials for conditions specified.

Bidder may offer valve with body and trim material better than the specified material and in such case, bidder shall furnish the comparisons of properties including cavitations resistance, corrosion resistance, temp. resistance, erosion resistance, hardness etc. of the offered material vis a vis specified material for owner approval.

11.02.04 **End Preparation**

1. Valve body ends shall be butt-welded type.
2. Flanged ends shall be of a pressure class equal or greater in pressure-temperature rating to the body design pressure and temperature indicated on the control valve. Unless otherwise specified, steel flanges shall be raised face type. Flanged ends for valves shall be in accordance with ANSI B 16.5.
3. Welded end for control valves where specified shall be socket-weld per ANSI B 16.11 for control valves of sizes 50 mm (2") and below and Butt welded connections per ANSI B16.25 for control valves 65 mm (2-1/2") and above. The end preparation for butt welded control valves shall be matched to the corresponding details for the piping on which the valve is installed.
4. All end preparations shall be as per Owners requirements indicated during Contract stage.

11.02.05 **Miscellaneous Parts**

1. Extension bonnets shall be used on all valves when the maximum temperature of the flowing fluid is greater than 275 deg. C or when specifically required in the control valve.
2. Stem travel indicators shall be provided on all valves.



11.03.00 VALVE OPERATIONS

- 11.03.01 All control valves shall be furnished with pneumatic spring opposed diaphragm, spring less diaphragm, or piston operators as specified herein.
- 11.03.02 The bidder shall be responsible for proper selection and sizing of valve operators in accordance with the pressure drop and maximum shut-off pressures.
- 11.03.03 Valve operators and stems shall be adequate to handle the unbalanced forces occurring under the specified flow conditions or the maximum differential pressure specified. An adequate allowance of stem force, at least 0.15 kg/sq. cm per linear millimeter of seating surface, shall be provided in the selection of the operator to assure tight seating unless otherwise specified. The operators shall be designed to produce the required stem force with supply air pressure of 3.5 kg/sq. cm maximum unless otherwise specified.
- 11.03.04 Diaphragms shall be moulded synthetic rubber and diaphragm housing shall be of pressed steel construction. Diaphragms shall not be fabricated of natural rubber.
- 11.03.05 Piston operators shall use cast pistons and cylinders with O-ring seals. Operators shall be supplied with name plates which indicate the diaphragm air pressure at full open and full closed positions. for single seated valves the pressures shall be listed for maximum differential and for zero differential across the valve.
- 11.03.06 Pistons and cylinders shall be cast aluminum. Piston rod and extension shall be chrome plated stainless steel. Cylinder seal bushings shall be brass and seal rings shall be nitrile. Yoke shall be cast iron.
- 11.03.07 Valve operators shall be capable of operating at 60 °C continuously.

11.04.00 CONTROL VALVE ACCESSORIES & DEVICES

The following accessory equipment shall be provided for control valves:

- 11.04.01 **Air Locks:** Air locks shall be designed to shut off the diaphragm loading air line if the supply air pressure to the associated pilot or Positioner fails. Air locks shall be of the automatic reset type and shall be furnished with alarms.
- 11.04.02 **Hand Wheels:** Hand Wheels shall be provided. Hand wheels shall be side mounted unless specified to be top mounted. However the mounting shall be as decided during engineering to offer maximum accessibility.
- 11.04.03 **Limit Switches:** Each control Valves shall be provided with limit switches for monitoring of end position in DDCMIS/DCS/PLC. Switches shall have not less than two normally open and two normally closed contacts in both open and close directions. Electrical rating of the limit switch contacts shall be 240V AC, 5 amp or 220V DC, 0.5 amp. Limit switches should be National Acme Co., or Honeywell micro switch type or Owner approved equal. The enclosures of the limit switches



shall be as per NEMA-4 Standard. Limit switches shall be constructed to withstand the temperatures encountered in the actual service. Explosion proof construction shall be furnished where required by applicable code or these specifications. Limit switches shall be factory mounted on the valves with provisions for adjusting the mounting. The Bidder shall stroke the valves to check limit switch operation prior to shipment.

Limit/micro switches can be offered as an integral part of Smart valve positioner.

- 11.04.04 **Smart Valve Positioner:** Control valve actuators for modulating and throttling services shall be provided with HART protocol based smart electro pneumatic valve Positioner to ensure accuracy & repeatability of response. The valve Positioner shall be designed suitable for vibration and service conditions of a steam electric power station.

The Positioner shall have the following features:

- a) Shall provide a pneumatic output signal of range 0.2 to 1.0 kg/cm² or as desired for the actuator.
- b) Shall have integral type position transmitter, input & output gauges, local keypad, display, 4-20 mA input and 4-20 mA output for position indication in DDCMIS/CCR/PLC.
- c) Shall be suitable for direct mounting on control valve assembly both for rotary & linear valves.
- d) Shall be capable of functioning under hot, humid & vibrating conditions.
- e) Shall have dust tight, corrosion resistant & weather proof IP 65 metal casing.
- f) Shall be operated at signal range of 4-20 mA for full travel of the valve. Split range operation in few case may be required. This facility shall also be available in positioner.
- g) Shall have in built mechanical position indicator.
- h) Shall have fail safe & fail freeze function as per loop process requirement.
- i) Shall have in built auto tune facility.

- 11.04.05 **Solenoid Valves:** Solenoid Valve will be provided for the following

- i. **ON / OFF Duty type Control Valve**
- ii. For over-riding the controller signal with Modulating type Control valves.
- iii. For control valve stay put position requirement on controller signal failure with Modulating type Control valves.
- iv. For construction and detailed specification of Solenoid valve, Chapter 3, Vol. V shall be referred by bidder.

- 11.04.06 **Diffusers :** Diffusers shall be provided as per service application requirements. The diffuser shall be designed to reduce the pressure drop across the control valve below the critical value and reduce the sound pressure level. Details of the diffusers shall be submitted.



11.04.07 **External Volume Chambers:** External volume chambers with adjustable bleed valves shall be provided for Control Valve. Volume chambers shall be furnished, mounted on the control valve yoke assembly.

11.04.08 **Position Transmitters:** Position transmitters shall be provided for control valves as a part of smart positioner. The signal shall be 4-20 mA DC range, 24 V DC. For non smart positioners applications and power cylinders, contact less position transmitter shall be provided by bidder.

11.04.09 **Tubing and Air Sets:** All pneumatic tubing required to interconnect devices assembled together shall be furnished complete with each control valve. The tubing shall be fully annealed soft temper copper tubing conforming to ASTM B68 to B75 (USA). Swage lock flare less tubing fittings shall be used for tubing connections (Swage lock or approved equal).

Each device requiring an air supply shall be equipped with a combination filter-regulator. Devices mounted together on a valve yoke may be served by a single regulator, provided the supply pressure is satisfactory and the regulator capacity is not exceeded. Filter-regulators shall be mounted on the device served.

Filter- regulators shall be suitable for a 10 kg/sq. cm maximum inlet pressure. Filter-regulators shall have built-in housing blow down valves and a 2 inch pressure gauge. The filter shall be of size not more than 5 microns and shall be made of sintered bronze.

11.04.10 **Pressure Switch**

Pressure switch suitable for the above the pneumatic system shall be provided. The contact rating shall be 2 A for 240 AC, .2 A, 220 VDC 2 SPDT Contact. Enclosure IP 65.

11.04.11 **I/P Converter**

For non smart positioners applications and power cylinders i/p converters shall be required and owner approval shall be obtained for the use of i/p converter for such applications.

Electro-pneumatic, outdoor type, field mounted Linear. 4-20 MA DC input and 0.2 – 1.0 kg/Cm² output. Die cast aluminum casing with IP65 or equivalent enclosure class. Accuracy of $\pm 0.5\%$ of span or better and repeatability of $\pm 0.5\%$ of span or better will be provided. Easily accessible span and zero adjustment will be provided I/P converter shall be provided with all accessories and erection hardware. The I to P converters shall retain the pneumatic signal (last value) even in failure of control signal and shall have self volume boosters.

11.04.12 **Separate moisture separator unit** for ensuring dryness of air entering I/P as well as the power cylinder is to be supplied **with each control valve and control damper.**

11.05.00 **FOR FOLLOWING CRITICAL APPLICATION SPECIAL CONTROL VALVES ARE REQUIRED.:**



Trim should be of multistage, multipath, multiturn type having **sufficient number of discrete pressure drop stages** to ensure elimination of erosion, cavitation, noise and vibration throughout the stroke length of the valve. Supplier shall **identify the number of pressure drop stages in proposed valve** and shall also provide calculations demonstrating compliance to the trim exit velocity.

The trim exit velocity for liquid (water) shall not exceed 23M/sec. The velocity head in case of steam / gas services shall be less than 480 Kpa (70 Psia). The supplier shall provide calculations demonstrating satisfactory compliance to the above criteria.

To maximize noise attenuation benefits and to allow for constant fluid expansion, flow direction shall be **'UNDER THE PLUG', i.e. FLOW TO OPEN.**

The flow path shall be radial and each disk element should be capable of reducing the entire pressure independently. No orifice, No mufflers / diffusers are permitted.

The maximum allowable noise level shall be less than 85 dba at 1 meter distance on bare pipe surface. **No orifice Plate downstream of the control valve should be used for pressure reduction.**

The specified noise level shall be achieved without the use of orifices, mufflers or diffusers. **No credit for thermal or acoustical insulations. The supplier shall provide calculations demonstrating compliance to the above noise requirement.**

The valve shall have minimum Ansi B-16-104 class-V leakage class in metal to metal seating for all applications with minimum seating force of 125kgf per linear mm of seat ring circumference. Soft seat is not acceptable. Vendor shall confirm that the proposed valve shall maintain tight shutoff leakage class even after 3 years of field service.

The valve shall have quick change type trim utilizing top entry. No components shall be screwed or welded into the body.

The valve shall have equal pressure distribution around the plug to avoid chattering/vibration.

The valve should have high rangeability to meet low flow and high flow requirements satisfactorily with high% show at low flow condition

Pneumatic double acting piston actuator shall be preferred.

11.07.00 **TESTING AND COMMISSIONING:**

11.07.01 All valves shall be tested in accordance with the quality assurance programme agreed between the owner and the bidder as specified in chapter 14 which shall meet the requirements of IBR and other applicable codes mentioned in chapter 1 clause-1.09.00. The tests shall include but not be limited to the following.



Valves for high pressure high temperature applications shall be subjected to 100% radiography examination test. Results shall be owner approved prior to dispatch. All castings and forging shall be visually inspected. The casting shall be radio graphically examined. Ultrasonic examination, liquid penetration examination, magnetic particle examination etc. as applicable shall be performed as per applicable standards and codes. The mechanical and chemical testing shall also Be performed in accordance with applicable ASTM material specification.

11.07.02 Non-destructive examinations shall be performed as required by ANSI B81.1 (Power Piping) and ANSI B16.34 (Steel Valves).

11. 07.03 Hydrostatic Test:

- ii) Valve shall be subjected to hydrostatic shell test in accordance with ANSI-B16.34 prior to seat leakage test. If the valves are reworked on the pressure parts for any reason after hydrostatic test, they must be retested.
- iii) Valves shall be hydrostatically tested in manufacturers works in accordance with code requirements. All hydrostatic testing and inspection shall be completed before any paint is applied to valve body. Certificates of inspection shall be executed in accordance with the latest codes and required codes shall be forwarded to the engineer.

All gaskets used for test shall be of the same material and design as specified for the finished product. Where mechanical gasket joints are broken following tests, new gaskets shall be furnished with the equipment, and the joints shall be retested.

11. 07.04 Leakage Test:

- i) Unless otherwise noted in the specification sheets, valve closure test and seat leakage tests shall be performed in accordance with ANSI B16.104, Leakage Class II/class IV as the case may be.
- ii) The leakage from packing shall be zero or bubble tight. For valve designs which are not covered by ANSI B16.104, the bidder shall submit the expected leakage rate with his proposal for review by Owner / Technical Specialist.
- iii) If valves are disassembled after the completion of the valve closure and seat leakage tests, these tests shall be repeated.

11. 07.05 Hysteresis Test :

The hysteresis test shall be run on completely assembled valves. The stuffing box shall be fully packed and made up hand tight. The allowable value of hysteresis specified by the bidder shall be achieved.

11.07.06 Tests for special class valves:

All valves supplied with the special class ratings per ANSI B16.34 "Steel Valves" (except flanged valves) shall be subject to the required examinations as per paragraph 8.3 of ANSI B16.34. the acceptance criteria shall be same as these given in Annexure B,C,D and E of ANSI B16.34 for the applicable examinations expect for the following.



Magnetic particle examination of castings, the linear indication shall not exceed 3/16 inch in length.

11.07.07

Functional Tests:

The fully assembled or completed valves including the operators control devices and accessories shall be functionally tested to demonstrate the operability of the valve and the operation. This may be done by cycling the valves 3 or 4 times from open to close position. The same controller can be used to test each valve. Control valve FI (Liquid pressure recovery factor) in operation test on completed valve (final inspection).



- iv. **Back up panel system** shall be designed for handling ~~the situation in clause 2.12.00 for failure of HMI.~~
- v. **For electrical layout, complete backup panel with mosaic** shall have to be provided for complete on/off operations with necessary meters, DDU's, synchroscope etc. as specified elsewhere in specification.
- iv. Control panel cum desk with HW annunciation windows, ILPBs, Ammeters, PBs, voltmeters, indicators, mimic, recorders etc. shall be provided as per Annexure A – Control System Philosophy for BOP packages. Profile/Overall GA of backup control panel cum desk for BOP packages shall be same as indicated in drawing no. 114-05-0105 attached with NIT.

2.06.00**PROTECTION, CLASS OF CABINETS / PANELS, ENCLOSURES ETC.**

- a) All panels, desks cabinets, consoles & enclosures furnished at least comply with the requirements of protection classes as indicated below.
 - 1. In-door Air-conditioned (A.C.) areas - IP32/42 (min.)
 - 2. In-door Non A.C. areas:
 - (a) Ventilated enclosures - IP42
 - (b) Non Ventilated. IP 54
 - 3. Out-door IP55 / IP65
(As per the requirement)
- b) Distribution boxes, junction boxes, cold junction compensation boxes, terminal boxes and all other field mounted equipment to be furnished as per this specification shall have weather protection conforming to IP 65.
- c) The design of panels, cabinets, enclosures and packaging density of components mounted therein shall be such that the temperature rise does not exceed 10 deg. C above the ambient under the worst conditions.
- d) The panels housing electronic hardware shall be provided with flame and smoke detectors by bidder.
- e) Enclosures for peripheral equipments like printers, etc. shall take care of noise and shall ensure minimum possible noise disturb to the working personnel.

2.06.01

Guards, barriers and access doors, covers of plates shall be marked to indicate the hazard, which may occur upon removal of such devices. Danger or caution signs shall be used to warn of specific hazards such as voltage or current. The marking shall be permanently affixed to the equipment.

2.07.00**~~System Documentation~~**

APPLICABLE CODES AND STANDARDS

1.08.00 CODES AND STANDARDS

1.08.01 All equipments, system and service covered under this specification shall comply with the requirements of the latest statutes regulations and safety codes as applicable in the locality where the equipments/systems will be installed. The Bidder shall fully acquaint himself with these requirements and shall ensure compliance with them.

The equipments, systems and services furnished as per this specification shall conform to the codes and standards mentioned in Cl. no. 1.08.02 of this Section. However in the event of any conflict between the requirements of two standards or between the requirements of any standard and this specification, the more stringent requirements shall apply unless confirmed otherwise by the Owner in writing. The decision of the Owner shall be final and binding in all such cases.

The Bidder's scope of supply shall include some items such as thermowells, and other in-line devices for main steam, hot reheat, cold reheat, feed water system falling under the purview of Indian Boiler Regulation (IBR) Act. It shall be the responsibility of the Bidder to obtain the necessary approval of the concerned Inspecting Authority/Chief Inspector of Boilers for the design and design calculations and manufacturing and erection procedures as called for under the IBR act for all items requiring such certifications.

The requirements of statutory authorities (e.g. MOEF, Inspectors of factories, IBR, TAC, BEE, CPCB/TNPCB etc) with regards to various plants areas like Main plant, Fuel oil plant/system, Chlorination Plant, Fire Fighting system, Emission Measurement, Ambient Air Monitoring system etc. shall be complied, even if not actually spelt out.

1.08.02 Reference Codes and Standards

The design, manufacture, inspection, testing, site calibration and installation of all equipment and systems covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable ANSI,



ASME, IEEE, NEC, NEMA, ISA, DIN, VDE, NFPA, IEC, EIA, TIA and Indian Standards and their equivalents. Bidder to note that in no case, OEM/manufacturers own standards shall be accepted.

1.08.02.01 Temperature Measurement

1. Performance Test Code for temperature measurement ASME PTC 19.3 (1974 – R 1998)
2. Temperature measurement - Thermocouples ANSI-MC 96.1 – 1982, IEC 584
3. Temperature measurement by electrical resistance thermometers - IS-2806.
4. Thermometer-element-platinum resistance-IS-2848, IEC 751/DIN 43760
5. RTD Design Code – DIN EN 60751:1996, BS EN 60751 : 2008
6. Thermowell Design Code – ASME PTC 19.3 TW – 2010

1.08.02.02 Pressure Measurement

1. Performance Test Code for pressure measurement - ASME PTC 19.2 (2010)
2. Bourdon tube pressure and vacuum gauges - IS 3624, IS 3602, ASME B 40.1

1.08.02.03 Electronic measuring Instruments & Control hardware

1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973), IS 9319
2. Safety requirements for electrical and electronic measuring and controlling instrumentation - ANSI C 39.5 - 1974.
3. Compatibility of analog signals for electronic industrial process instruments - ISA-S 50.1:ANSI MC 12.1 - 1975.
4. Dynamic response testing of process control instrumentation - ANSI MC 4.1 (1975): ISA-S26 (1968).
5. Surge withstand capability (SWC) tests - ANSI C 37.90A (1974) IEEE Std. 472 (1974). IEC – 255.4.
6. Printed circuit boards - IPC TM-650, IEC 326 C
7. General requirements and tests for printed wiring boards - IS 7405 (Part-I) - 1973
8. Edge socket connectors - IEC 130-11.
9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2.
10. Dimensions of attachment plugs & receptacles ANSI C73-1973.
11. Direct acting Electrical Indicating Instruments: IS-1248-1968.

1.08.02.04 Instrument Switches and Contacts

1. Contact rating - AC services NEMA ICS Part-2 125, A600
2. Contact rating - DC services NEMA ICS Part-2-125, N600.



1.08.02.09 Enclosures

1. Types of enclosures - NEMA Std. ICS-6-110.15 through 110.22 (Type 4 to 13).
2. Racks, panels, and associated equipment - EIA: RS-310-B (ANSI C83.9 - 1972)
3. Protection Class for Enclosure, Cabinets, Control Panels and Desks - IS-13947-1962.

1.08.02.15 Instrument Tubing

1. Seamless carbon steel pipe - ASTM - A106.
2. Material for socket weld fittings - ASTM - A105.
3. Dimensions of fittings - ANSI B16.11
4. Code for pressure piping, welding, hydrostatic testing - ANSI B31.1.

1.08.02.18 Flow measurement

1. ASME Performance Test Code PTC-19.5 (2004), ISA RP3.2
2. BS 1042
3. ISO 5167

1.08.02.11 Sampling System

1. Stainless steel material of tubing and valves for sampling system - ASTM A269-82 Gr TP316.
2. Submerged helical coil heat exchangers for sample coolers ASTM D 11-98.
3. Water and Steam in power cycle - ASME PTC 19.11(2008).
4. Standard methods of sampling system - ASTM D 1066-69.

1.08.02.14 Process Connection and Piping:

1. Codes for pressure piping power piping ANSI B31.1
2. Seamless carbon steel pipe ASTM A-106.
3. Forged and Rolled Alloy steel pipe flanges, forged fittings, valves and parts - ASTM A-182.
4. Material for socket welded fittings - ASTM A-105.
5. Seamless ferrite alloy steel pipe - ASTM A-335.
6. Pipe fittings of wrought carbon steel and alloy steel - ASTM A-234.
7. Composition bronze or metal castings - ASTM B-62.
8. Seamless copper tube, bright annealed ASTM B-168.
9. Seamless copper tube - ASTM B-75.
10. Dimensions of fittings - ANSI B-16.11
11. Valves flanged and butt welding ends - ANSI B16.34.
12. Nomenclature for Instrument tube fittings ISA-RP-42.1 - 1982.



QUALITY ASSURANCE PLAN/CHECK LIST

CHAPTER-14**QUALITY ASSURANCE AND TESTING AND GUARANTEES****14.01.00 GENERAL REQUIREMENT**

- 14.01.01** All equipment furnished under this specification shall be subject to test by authorized quality assurance personnel of the Bidder, representatives of the Owner during manufacture, erection and on completion. Bidder quality assurance personnel for these shop and site tests shall be identified in advance and shall be acceptable to the Owner. The approval of the Owner or passing of such inspection of tests will not, however, prejudice the right of the owner to reject the equipment if it does not comply with the specifications when erected or fails to give complete satisfaction in service.
- 14.01.02** The Bidder shall furnish details of shop and site tests proposed to be conducted by him at various stages to meet the specification requirements for each type of instrument/system along with his proposal. Bidder shall also furnish details of his proposed shop and site quality assurance organization for this contract
- 14.01.03** Bidder shall prepare a detailed shop and site 'Quality Assurance Programme' to meet the requirements of these specifications for Owner's approval. This document shall also contain the formats for reports and maintenance of test records specification of test equipment to be used for site tests.
- 14.01.04** All equipment and systems furnished under this specification shall be subjected to shop & site tests in accordance with the Quality Assurance Program approved by the Owner and shall be adequate to ensure full compliance with these specification, all applicable codes & standards and detailed engineering drawings and documents approved by the Owner.
- 14.01.05** The Bidder shall provide all required test equipment and simulation devices for performing all shop and site tests. All tests equipment shall be of reputed make, required accuracy class and shall be recently calibrated. The record of calibration of test equipment shall be made available to the Owner on demand.
- 14.01.06** The cost of all tests as per the requirements of this specification and approved quality assurance programme shall be included in Bidder's lump sum price for this package and no extra price shall be payable by the Owner for conducting any test as per the intent and requirements of this specification.
- 14.01.07** All approval/Inspection are to be carried out by the Owner only.



14.02.04.21 Calibration of Instruments

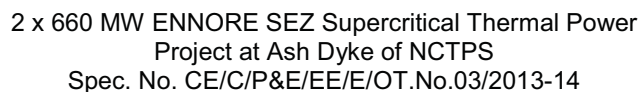
The Bidder shall carry out the calibration of instruments as indicated below by submitting the test procedure and quality assurance plan for the Owner's approval. Bidder shall also prepare detailed checklist/calibration sheets for each of the systems/equipment clearly indicating the step-by-step procedures to be carried out for calibration pre commissioning, loop checking, powering and commissioning.

The calibration of all instruments shall be checked and calibration records prepared for the Owner's use. If the instruments require recalibration, Bidder shall recalibrate the instruments and revise the calibration records and submit to the Owner.

i TESTS TO BE PERFORMED FOR FIELD INSTRUMENTS

1.	Pressure Gauges
	Calibration Hydro test (1.5 times max. pr.)
2.	Pressure switches
	Calibration test / Hydro test / Contact rating test / Accuracy test / Repeatability
3.	Differential Pressure Gauges
	Calibration test / Hydro test / Leak test / Over range test / Accuracy test / Repeatability test.
4.	Differential Pressure Switches
	Calibration test / Hydro test / Contact rating test / Leak test / Accuracy test / Repeatability test.
5.	Thermometers
	Calibration / Material test / Accuracy test / Bore concentricity : $\pm 5\%$ of wall thickness / Hydrostatic test for TW (1.5 times max. pr.)
6.	Temperature switch
	Calibration / Material test / Accuracy test / Bore concentricity : 1.5% of wall thickness / Hydrostatic test for TW (1.5 times max. pr.) / Contact rating test.
7.	Resistance temperature detector assembly.
	Calibration / Material test / Bore concentricity test / Insulation test ($\leq 500 \text{ M}\Omega$ at 500V DC) as per ISA, Hydro test for TW. Bore concentricity: $\pm 5\%$ of wall thickness, Accuracy test.
8.	Thermocouple assembly
	Calibration / Material test, Insulation test ($\geq 500 \Omega$ at 500 V, DC) as per ISA, Hydro static test (1.5 times max. pr.), Bore concentricity : $\pm 5\%$ of wall thickness.
9.	Thermowells
	Material test / Bore concentricity : $\pm 5\%$ of wall thickness / Hydrostatic test for TW (1.5 times max. pr.)





	Hydro test, IBR Certificate
28.	Sampling racks :
	Hydro test, IBR Certificate for tubes and fittings.
29.	S02 / Nox analyser / SPM analyser:
	Calibration test, accuracy test
30.	Interposing relay
	Functional test, temperature rise test, H.V test, Insulation test
31.	Transmitter Racks :
	Hydro test, air leak test for piping / tubing and fittings. IBR certification as required for tubing / piping and fittings.
32.	Pressure Transmitter
	Calibration test / Hydro test / Leak test / Over range test / Accuracy test / Repeatability test.
33.	Differential pressure transmitter
	Calibration test / Hydro test / Leak test / Over range test / Accuracy test / Repeatability test.
34.	Temperature Transmitter
	Calibration test / Accuracy test / Ambient temperature error test
35	Pneumatic Block Valves
	a) IBR certificate form III C b) Hydrostatic test : ANSI B 16.34 c) Seat leakage test : As per ANSI B 16-104 d) CV test: As per ISA procedure e) Magnetic particle test ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 DegC) f) Liquid penetration test: ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 DegC) g) Radiography test: ANSI B 16.34 special class h) Calibration and Hysteresis test i) Actuator leakage test
36.	Pressure Regulating Valve



	a) IBR certificate form III C b) Hydrostatic test : ANSI B 16.34 c) Seat leakage test : As per ANSI B 16-104 d) CV test: As per ISA procedure e) Magnetic particle test ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 DegC) f) Liquid penetration test: ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 DegC) g) Radiography test: ANSI B 16.34 special class h) Calibration and Hysteresis test i) Actuator leakage test
37.	Local Panels : Visual inspection, wiring & continuity check, H.V. and I.R. tests on panels, checking of bill of materials, functional tests.
38	Wiring Termination & Accessories
	Routine test: Conductor resistance test/High voltage test/Impulse dielectric test/insulation test/Humidity test/Temperature rise test on power circuits/short time current test on power circuits.
	Type test:Annealing test/Test for insulation and sheath/ Flame retardance test - a) Oxygen index, b) Flammability / Test for acid gas generation/test for water absorption/wet dielectric test
39	Marshalling/System cabinets
	Verification of degree of protection/Electrical tests as detailed under wiring Termination& accessories/Type test and routine test as per relevant Indian standards.
	Notes:
	1. Test Certificates in addition to inspection at manufacturers works shall be furnished for all the instruments for Owner's review.
	2. Above Test to be witnessed shall be finalized by Owner.
	3. In addition to above test, test as per approved QAP shall also be witnessed by owner.

17.02.05 TYPE TESTING

The BIDDER shall furnish the Type test reports of all type tests as per relevant standards and codes. As well as other specifics test indicated in the specification. A list of such test are given for various equipment in table titled, TYPE TEST REQUIREMENT FOR C&I SYSTEM and under the item special requirement for solid state requirements/systems. For the balance equipments/instruments. type test may be conducted as per manufacturer standards or if required by relevant standards.

A. Out of these test listed , the bidder /subvendor/manufacture is required



to conduct certain type test specifically for this contract (and witnessed by employer or his authorized representative). Even if the same have been conducted earlier as clearly indicated subsequently such tests.

- B. For the rest, submission of type test , results, and certificates shall be acceptable provided following points
- i. The same have been carried out by the bidder/ subvendor on exactly the same model/rating of equipment. (For control valves this shall be same size, type & design).
 - ii. There has been no change in the components from the offered equipments and tested equipments.
 - iii. The test has been carried out as per the latest standards along with amendements as on the date of bid opening.
- C. In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the bidder/sub-vendor within the quoted price and no extra cost will be payable by the owner on this account.

17.02.05.1 As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main bidder or his authorized representative and balanced have to be approved by the employer.

The schedule of conduction of type test/submission of reports shall be submitted and finalized during pre award discussion.

17.02.05.2 For the type test to be conducted, bidder shall submit detailed test procedure for approval by owner. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable). , recording of different parameters, intervals of recording precaution to be taken etc. for the test to be carried out.



17.02.05.4 TYPE TEST REQUIREMENTS FOR C&I SYSTEMS

S.No.	Item	Test requirement	Standard	Test to be specifically conducted	Owner's Approval required on Test Certificate
1	Electrical metering instruments	As per standards	IS 1248	No	Yes
2	Thermocouple	Degree of Protection Test	IS - 13947	No	No.
3	Junction Box	Degree of Protection Test	IS - 13947	Yes	Yes
4	RTD	As per standards	IEC-60751	No	No
5	Electronic Transmitter	As per standards	BS 6447/IEC 60770	No	Yes
6	E/P convertor	As per standards	Manufacturing standard	No	Yes
7	Instrumentation cable (Twisted and shielded) (Refer Vol. V, Chapter 9)				
8	Battery	As per standard	IS 10918	Yes	YES
9.	Voltage stabiliser	Over load test	Approved procedure	No	YES
		Temp. rise test without redundant fans	Approved procedure	No	YES
		Input voltage variation test	Approved procedure	No	YES



12	Local gauges	Degree of protection test	IS 13947	No	No
13	Process actuated switches	Degree of protection test	IS 13947	No	No
16	LIE/LIR	Degree of protection test	IS 13947	YES	YES
18	Flow Orifice plates	calibration	ASME PTC BS 1042	YES	YES

Note:

Type test are to be conducted only for the items, which are being supplied as part of this package.





STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR ANALYTICAL INSTRUMENTS

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V	
	VISUAL						
	MAKE, MODEL No.						
	POWER SUPPLY						
	TYPE						
2	DIMENSIONS CHECK			P	V	V	
3	FUNCTIONAL CHECK			P	V	V	
4	LEAKAGE TEST			P	V	V	
5	HV / IR TEST			P	V	V	
6	LINEARITY			P	V	V	
7	RESPONSE TIME			P	V	V	
8	ENCLOSURE CLASS			P	V	V	
9	ACCESSORIES, AS APPLICABLE			P	V	V	
10	ACCURACY / CALIBRATION			P	V	V	
11	ALARM CONTACT TEST			P	V	V	
12	ANALOG OUTPUT CHECK			P	V	V	
13	BURN-IN TEST OF ELECTRONIC PARTS	1/LOT		P	V	V	
14	IN-BUILT INDICATOR, ZERO, SPAN, RANGE SCALE SELECTION ETC	SEE NOTE-1 BELOW		P	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TRANSMITTER

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECKS FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	VISUAL.						
	MODEL/TAG No						
2	PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	REPEATABILITY			P	W	V	
5	HYSTERESIS			P	W	V	
6	EFFECT OF TEMP VARIATION ON ACCURACY			P	W	V	
7	SPAN / ZERO ADJUSTMENT	ONE / TYPE		P	W	V	
8	EFFECT OF SUPPLY VOLTAGE VARIATION			P	W	V	
9	EFFECT OF LOADING (500 OHM METERS)			P	W	V	
10	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
11	BURN-IN TEST	ONE / TYPE		P	W	V	
12	DEGREE OF PROTECTION			P	W	V	
13	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- When material corelation are not available manufacturer's compliance to be provided.
- Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR SOLENOID VALVES

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE						
	MAKE						
	MODEL No.						
2	MATERIAL (BODY. PLUNGER/TRIM)			P	W	V	
3	PORT SIZE			P	W	V	
4	CABLE CONNECTION SIZE			P	W	V	
5	ENCLOSURE CLASS			P	W	V	TYPE TEST CERTIFICATE TO BE FURNISHED BY VENDOR
6	No. OF COILS & INSULATION CLASS			P	W	V	TEST CERTIFICATE TO BE FURNISHED FOR INSULATION CLASS BY VENDOR
7	POWER SUPPLY CHECK			P	W	V	
8	IR / HV TEST			P	W	V	
9	FUCTIONAL TEST			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

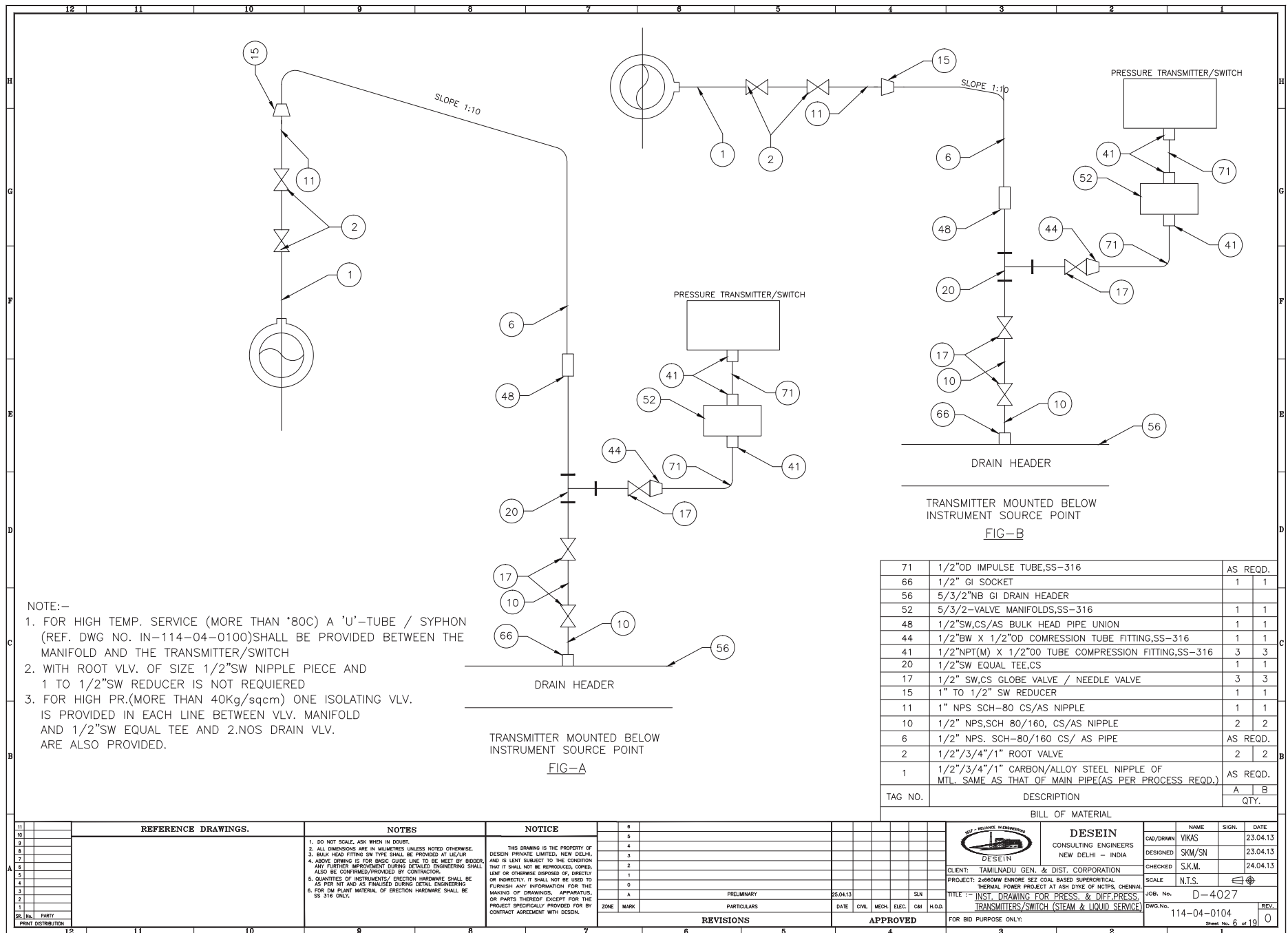
- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

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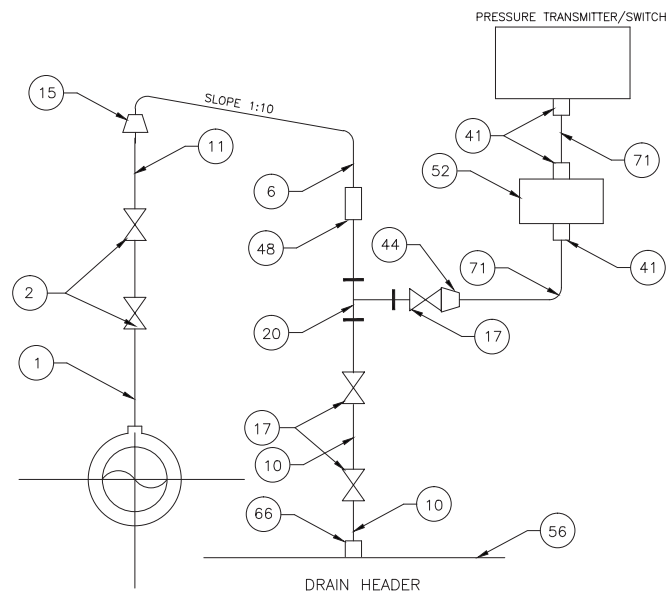
** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

1. Quantum of check shall be as below :
100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. Contractor to provide compliance certificate for tests/checks verified by contractor and the same alongwith test certificates to be verified by BHEL

INSTRUMENT INSTALLATION DIAGRAM

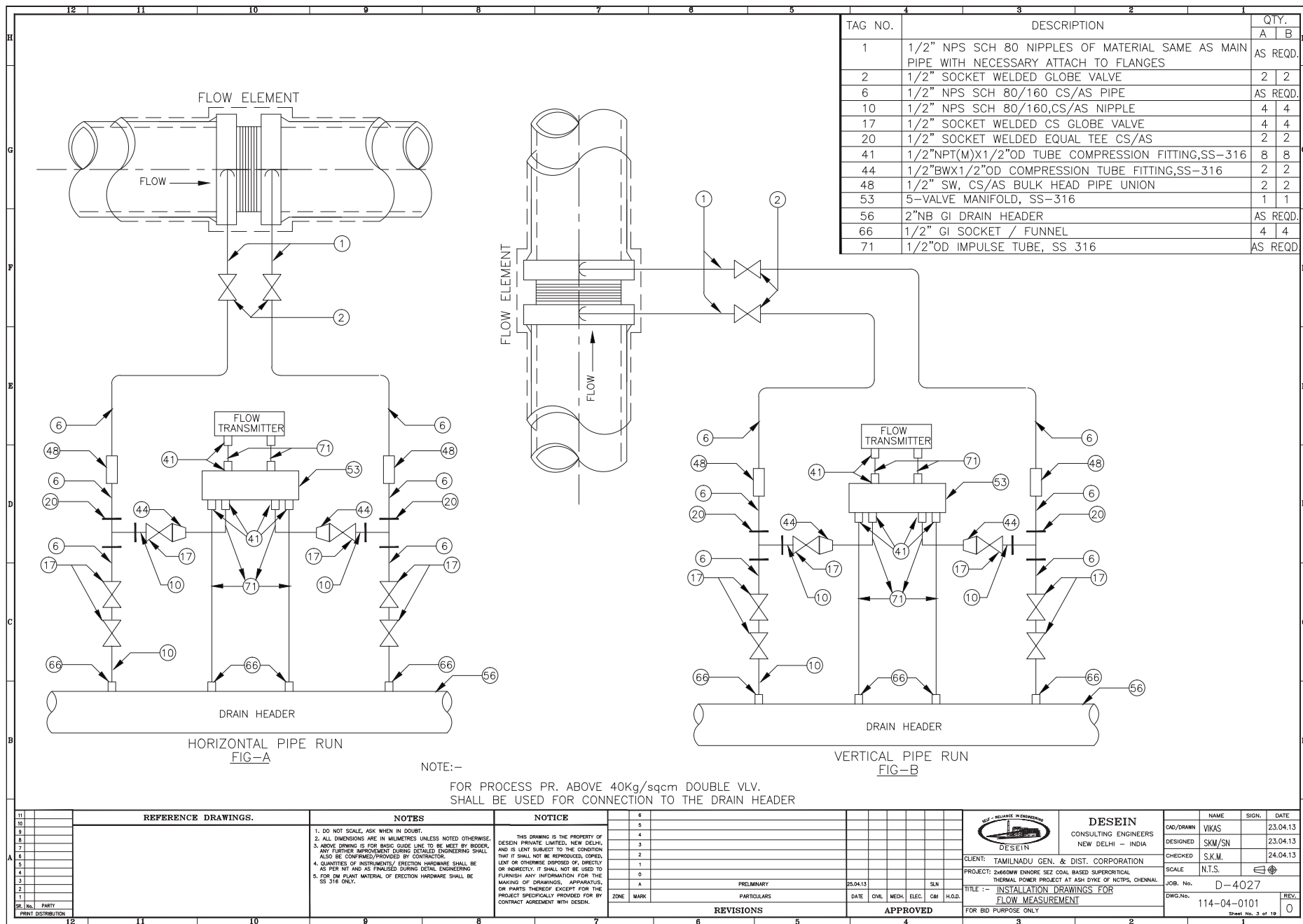


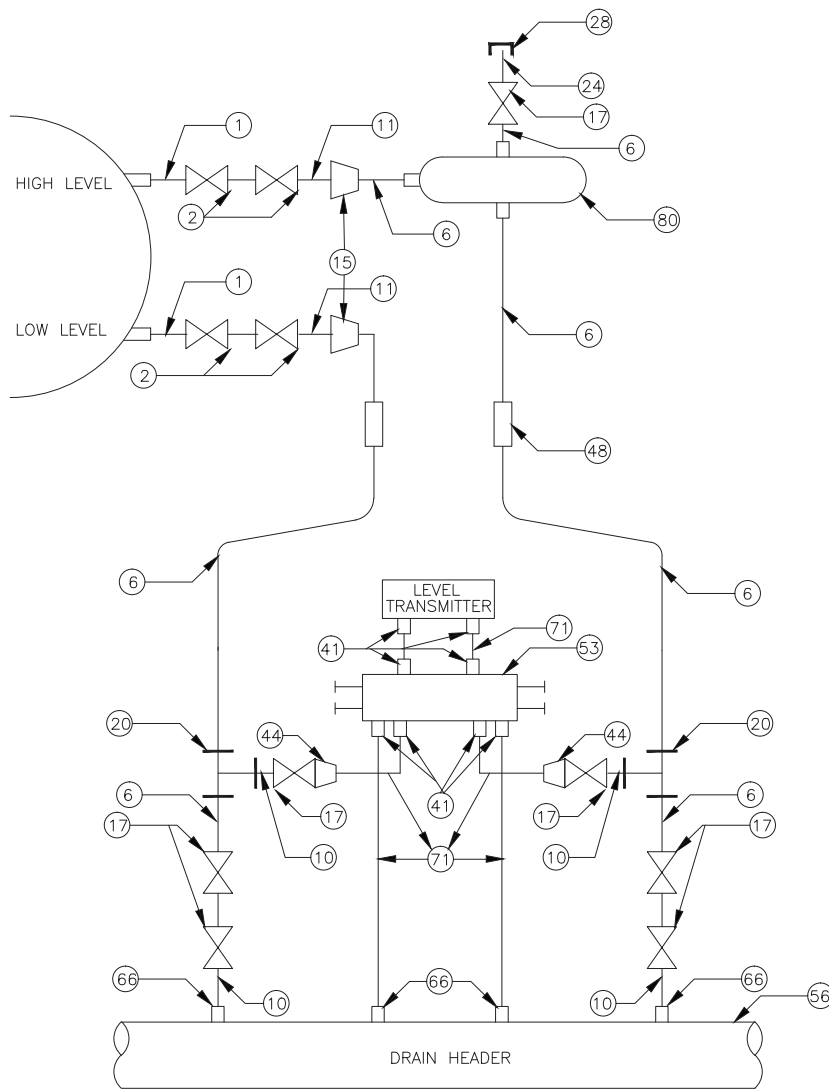
1. FOR HIGH TEMP. SERVICE (MORE THAN 80C) A 'U'-TUBE / SYPHON (REF. DWG NO. IN-114-04-0100) SHALL BE PROVIDED BETWEEN THE MANIFOLD AND THE TRANSMITTER/SWITCH
2. WITH ROOT VLV. OF SIZE 1/2"SW NIPPLE PIECE AND 1 TO 1/2"SW REDUCER IS NOT REQUIRED
3. FOR HIGH PR.(MORE THAN 40Kg/sqcm) ONE ISOLATING VLV. IS PROVIDED IN EACH LINE BETWEEN VLV. MANIFOLD AND 1/2"SW EQUAL TEE AND 2.NOS DRAIN VLV. ARE ALSO PROVIDED.



BILL OF MATERIAL			
		DESEIN CONSULTING ENGINEERS NEW DELHI - INDIA	
CLIENT: TAMILNADU GEN. & DIST. CORPORATION		CAD/DRAWN: VKAS CHECKED: SKM/SN DESIGNED: S.K.M. SCALE: N.T.S.	23.04.13 23.04.13 24.04.13
PROJECT: 2x60MW ENCORE 322 COAL BASED SUPERCRITICAL THERMAL POWER PROJECT AT ARIYANKUDU OF NCTPS, CHENNAI		TITLE: NISF DRAWING FOR PRESS. & DEF PRESS. TRANSMITTERS/SWITCH (STEAM & LIQUID SERVICE)	JOB NO. D-4027 DWG. NO. 114-04-0104
FOR BID PURPOSE ONLY		DWG. NO. 114-04-0104 REV. 7	23.04.13 23.04.13 23.04.13

11	REFERENCE DRAWINGS.			NOTES			NOTICE			6													NAME			SIGN.			DATE																				
10										5													CAD/DRAWN			Vikas			23.04.13																				
9										4																DESIGNED			SKM/SN			23.04.13																	
8										3																			CHECKED			S.K.M.			24.04.13														
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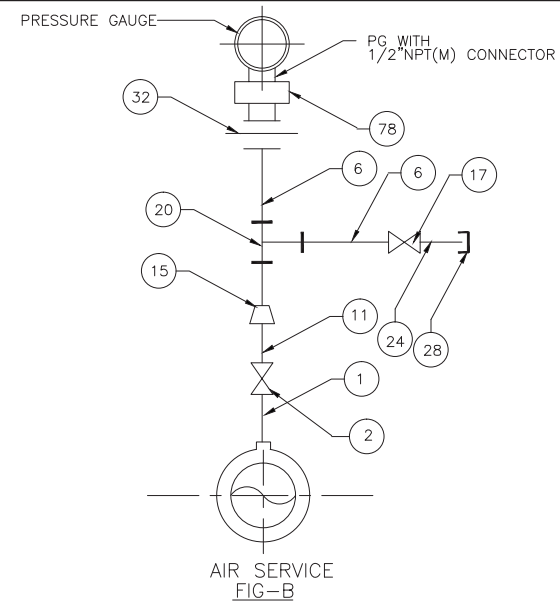
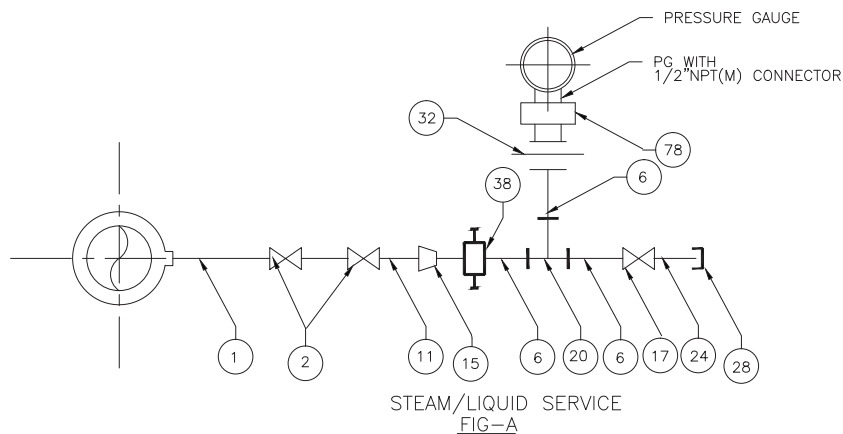
TRANSMITTER MOUNTED BELOW INST. SOURCE POINT

TAG NO.	DESCRIPTION	BOM
80	CONDENSATION CHAMBER	1
71	1/2"OD IMPULSE TUBE, SS-316	AS REQD.
66	1/2" GI SOCKET / FUNNEL	4
56	2"NB GI DRAIN HEADER	AS REQD.
53	5-VALVE MANIFOLD, SS-316	1
48	1/2" SW, CS/AS BULK HEAD PIPE UNION	2
44	1/2"BX1/2"OD COMPRESSION TUBE FITTING,SS-316	2
41	1/2"NPT(M)X1/2"OD TUBE COMPRESSION FITTING,SS-316	8
28	1/2" NPT (F) CS CAP	1
24	1/2" NPS SCH-80/160X1/2"NPT(M) CS/AS NIPPLE	1
20	1/2" SOCKET WELDED EQUAL TEE CS/AS	2
17	1/2" SOCKET WELDED CS GLOBE VALVE	7
15	1"TO 1/2" SOCKET WELD REDUCER	2
11	1" NPS SCH 80/160 CS/AS NIPPLE	2
10	1/2" NPS SCH 80/160,CS/AS NIPPLE	4
6	1/2" NPS SCH 80/160 CS/AS PIPE	AS REQD.
2	1/2"/3/4"/1" SOCKET WELDED GLOBE VLV/ROOT VLV.	4
1	1/2" NPS SCH 80 NIPPLES OF MATERIAL SAME AS MAIN PIPE WITH NECESSARY ATTACH TO FLANGES	AS REQD.
TAG NO.	DESCRIPTION	BOM

NOTE:-

- FOR HIGH TEMP. SERVICE (MORE THAN 80°C) A 'U' TUBE(REF. DWG NO. 114-04-0100) SHALL BE PROVIDED BETWEEN THE MANIFOLD AND THE TRANSMITTER
- FOR HIGH PR.(MORE THAN 40kg/sqcm) ONE NO. OF ISOLATING VLV. IS PROVIDED IN EACH LINE BETWEEN VLV. MANIFOLD AND 1/2"SW EQUAL TEE AND 2NO. DRAIN VLV. ARE ALSO

11	10	9	8	7	6	5	4	3	2	1
REFERENCE DRAWINGS.				NOTES				NOTICE		
				1. DO NOT SCALE, ASK WHEN IN DOUBT. 2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. 3. BULK HEAD FITTING SW TYPE SHALL BE PROVIDED AT LEISURE. 4. ABOVE DRAWING IS FOR BASIC GUIDE LINE TO BE MET BY BIDDER, ANY FURTHER IMPROVEMENT DURING DETAILED ENGINEERING SHALL ALSO BE CONFIRMED/PROVIDED BY CONTRACTOR. 5. QUANTITIES OF INSTRUMENTS/ ERECTION HARDWARE SHALL BE AS PER INT. AND AS FINALISED DURING DETAIL ENGINEERING. 6. FOR CM PLANT MATERIAL OF ERECTION HARDWARE SHALL BE SS 316 ONLY.				THIS DRAWING IS THE PROPERTY OF DESEIN PRIVATE LIMITED, NEW DELHI, AND IS LENT SUBJECT TO THE CONDITION THAT IT SHALL NOT BE REPRODUCED, COPIED, LENT OR OTHERWISE DISPOSED OF, DIRECTLY OR INDIRECTLY. IT SHALL NOT BE USED TO FURNISH ANY INFORMATION FOR THE MAKING OF DRAWINGS, APPARATUS, OR PARTS THEREOF EXCEPT FOR THE PROJECT SPECIFICALLY PROVIDED FOR BY CONTRACT AGREEMENT WITH DESEIN.		
				PRELIMINARY DATE: 25.04.13 MECH: SLN				DESEIN CONSULTING ENGINEERS NEW DELHI - INDIA		
				REVISIONS APPROVED				CLIENT: TAMILNADU GEN. & DIST. CORPORATION PROJECT: 2x660MW ENHANCE SEZ COAL BASED SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI. TITLE :- INST. DRAWING FOR LEVEL TRANSMITTERS		
								FOR BID PURPOSE ONLY:		
								NAME: VIKAS SIGN: SKM DATE: 23.04.13 SCALE: N.T.S. DWG.No. 114-04-0110 Sheet No. 13 of 19		



78	1/2"NPT(F)X1/2"NPT(M) SNUBBER/PULSATION DAMPER	1	1
59	1/2"SW, STRAIGHT PIPE CONNECTOR, CS/AS	—	—
38	3 WAY GAUGE VALVE 1/2" NB SW	1	—
37	6" COILED SYPHON SCH 80/160 1/2"NB CS/SS	—	—
32	1/2"NPS,3PIECE PIPE UNION WITH 1/2"NPT(F) SCREWED	1	1
28	1/2"NPT (F) CS CAP	1	1
24	1/2"NPS,SCH-80/160X1/2"NPT(M)CS/AS NIPPLE	1	1
20	1/2"SW EQUAL TEE, CS/AS	1	1
17	1/2" SW CS/AS GLOBE VALVE	1	1
15	1" TO 1/2" SOCKET WELDED REDUCER	1	1
11	1" NPS SCH-80/160 CS/AS NIPPLE	1	1
6	1/2" NPS. SCH-80/160 CS/ AS PIPE	AS REQD.	
2	1/2"/3/4"/1" ROOT VALVE-SW GLOBE VALVE	2	1
1	1/2"/3/4"/1" CARBON/ALLOY STEEL NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PER PROCESS REQD.)	AS REQD.	
TAG NO.	DESCRIPTION	A	B
		QTY.	
BILL OF MATERIAL			

REFERENCE DRAWINGS. 11. _____ 10. _____ 9. _____ 8. _____ 7. _____ 6. _____ 5. _____ 4. _____ 3. _____ 2. _____ 1. _____		NOTES 1. DO NOT SCALE, ASK WHEN IN DOUBT. 2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. 3. ABOVE DRAWING IS FOR BASIC GUIDE LINE TO BE MET BY ROOOF, ANY FURTHER IMPROVEMENT DURING DETAILED ENGINEERING SHALL ALSO BE CONFIRMED/PROVIDED BY CONTRACTOR. 4. QUANTITIES OF INSTRUMENTS/ ERECTION HARDWARE SHALL BE AS PER INT AND AS FINALISED DURING DETAIL ENGINEERING. 5. PRESSURE GAUGE SHALL BE PROVIDED WITH SS-316. 6. FOR DM PLANT MATERIAL OF ERECTION HARDWARE SHALL BE SS 316 ONLY.		NOTICE THIS DRAWING IS THE PROPERTY OF DESEIN PRIVATE LIMITED, NEW DELHI, AND IS LENT SUBJECT TO THE CONDITION THAT IT SHALL NOT BE REPRODUCED, COPIED, LENT OR OTHERWISE DISPOSED OF DIRECTLY OR INDIRECTLY. IT SHALL NOT BE USED TO FURNISH ANY INFORMATION FOR THE MAKING OF DRAWINGS, APPARATUS, OR PARTS THEREOF EXCEPT FOR THE PROJECT SPECIFICALLY PROVIDED FOR BY CONTRACT AGREEMENT WITH DESEIN.		REVISIONS <table border="1"> <tr> <th>NO.</th> <th>DATE</th> <th>BY</th> <th>REASON</th> </tr> <tr> <td>1</td> <td>23.04.13</td> <td>SKM</td> <td>PRELIMINARY</td> </tr> </table>		NO.	DATE	BY	REASON	1	23.04.13	SKM	PRELIMINARY	APPROVED <table border="1"> <tr> <th>DATE</th> <th>CIVIL</th> <th>MECH.</th> <th>ELEC.</th> <th>CMJ</th> <th>H.O.D.</th> </tr> <tr> <td>23.04.13</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		DATE	CIVIL	MECH.	ELEC.	CMJ	H.O.D.	23.04.13						 DESEIN CONSULTING ENGINEERS NEW DELHI - INDIA CLIENT: TAMILNADU GEN. & DIST. CORPORATION PROJECT: 2x660MW DANORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER PROJECT AT ASH DIKE OF NCTPS, CHENNAI. TITLE :- INST. DRAWING FOR LOCAL PRESSURE GAUGE FOR BID PURPOSE ONLY		<table border="1"> <tr> <th>NAME</th> <th>SIGN.</th> <th>DATE</th> </tr> <tr> <td>QAD/DRAWN</td> <td>VIKAS</td> <td>23.04.13</td> </tr> <tr> <td>DESIGNED</td> <td>SKM/SN</td> <td>23.04.13</td> </tr> <tr> <td>CHECKED</td> <td>S.K.M.</td> <td>24.04.13</td> </tr> <tr> <td>SCALE</td> <td>N.T.S.</td> <td></td> </tr> <tr> <td>JOB. No.</td> <td colspan="2">D-4027</td> </tr> <tr> <td>DWG.No.</td> <td>114-04-0106</td> <td>REV. 0</td> </tr> </table> Sheet No. 9 of 10		NAME	SIGN.	DATE	QAD/DRAWN	VIKAS	23.04.13	DESIGNED	SKM/SN	23.04.13	CHECKED	S.K.M.	24.04.13	SCALE	N.T.S.		JOB. No.	D-4027		DWG.No.	114-04-0106	REV. 0
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1	23.04.13	SKM	PRELIMINARY																																																			
DATE	CIVIL	MECH.	ELEC.	CMJ	H.O.D.																																																	
23.04.13																																																						
NAME	SIGN.	DATE																																																				
QAD/DRAWN	VIKAS	23.04.13																																																				
DESIGNED	SKM/SN	23.04.13																																																				
CHECKED	S.K.M.	24.04.13																																																				
SCALE	N.T.S.																																																					
JOB. No.	D-4027																																																					
DWG.No.	114-04-0106	REV. 0																																																				

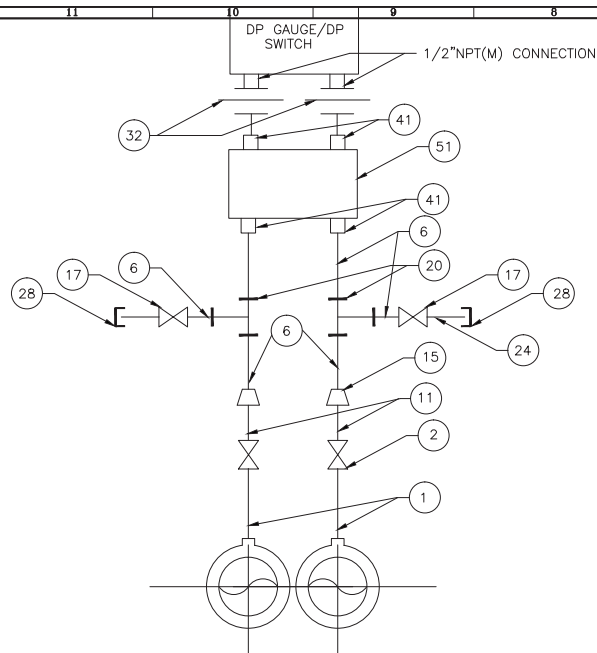


FIG-A

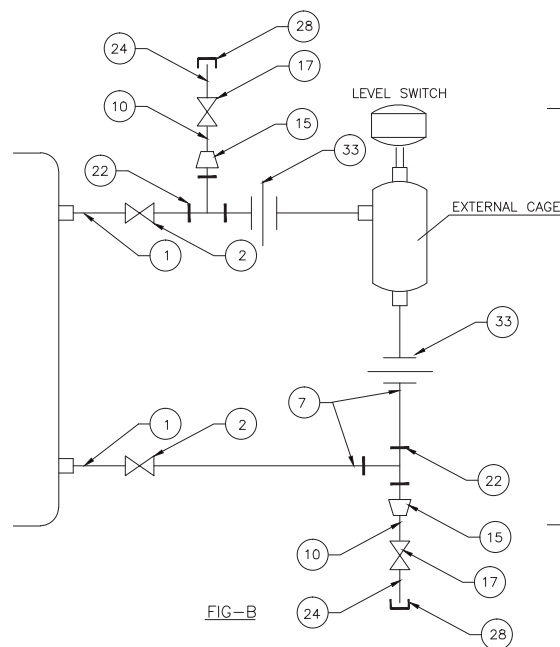


FIG-B

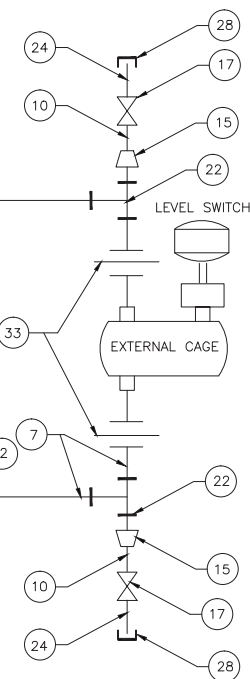


FIG-C

NOTE:-
WITH VALVE OF SIZE 1/2\"/>

78	1/2" NPT(F) X 1/2" NPT(M) SNUBBER/PULSATION DAMPNER	1	—	—
51	5 VALVE MANIFOLDS, SS-316	—	—	—
41	1/2" NPT(M) X 1/2" OD TUBE COMPRESSION FITTING,SS-316	—	—	—
38	3 WAY GAUGE VALVE 1/2"NB SW	1	—	—
33	1" SW EQUAL PIPE UNION	—	2	2
32	1/2" NPS,3 PIECE PIPE UNION 1/2" NPT(F) SCREWED AND 1/2" SW CONNECTION	1	—	—
28	1/2" NPT(F) CS. CAP	1	2	2
24	1/2" NPS,SCH 80/160 X 1/2" NPT(M) CS/AS NIPPLE	1	2	2
22	1" SW EQUAL TEE CS/AS	—	1	2
20	1/2"SW EQUAL TEE CS/AS	1	—	—
17	1/2" SW,CS/AS, GLOBE VALVE	1	2	2
15	1" TO 1/2" SOCKET WELD REDUCER	1	2	2
11	1"NPS SCH 80/160 CS/AS NIPPLE	1	—	—
10	1/2"NPS,SCH 80/160 CA/AS NIPPLE	—	2	2
6	1/2"NPS,SCH 80/160 CARBON/ALLOY STEEL PIPE	AS REQD.		
7	1" NPS,SCH 80/160 CS/AS STEEL PIPE	AS REQD.		
2	1/2"3/4"/1" ROOT VALVE — SW GLOBE VALVE	2	2	2
1	1/2"/3/4"/1" CARBON/ALLOY STEEL NIPPLE OF MTL SAME AS THAT OF MAIN PIPE (AS PER PROCESS REQD.)	AS REQD.		
TAG NO.	DESCRIPTION	A	B	C
		QTY.		

11	REFERENCE DRAWINGS.	NOTES	NOTICE
10		1. DO NOT SCALE, ASK WHEN IN DOUBT.	
9		2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.	
8		3. ABOVE DRAWING IS FOR BIDDING PURPOSE ONLY. ANY FURTHER IMPROVEMENT DURING DETAILED ENGINEERING SHALL ALSO BE CONFIRMED/PROVIDED BY CONTRACTOR.	
7		4. QUANTITIES OF INSTRUMENTS/ ERECTION HARDWARE SHALL BE AS PER INT AND AS FINALISED DURING DETAIL ENGINEERING	
6		5. FOR O&M PLANT MATERIAL OF ERECTION HARDWARE SHALL BE SS 316 ONLY.	
5			
4			
3			
2			
1			
SR. No.	PARTY		

6	REVISIONS	APPROVED
5		
4		
3		
2		
1		
0		
A	PRELIMINARY	25.04.13
ZONE	PARTICULARS	DATE CIVIL MECH. ELEC. C&I H.O.D.

		DESEIN CONSULTING ENGINEERS NEW DELHI — INDIA	NAME	SIGN.	DATE
CLIENT: TAMILNADU GEN. & DIST. CORPORATION PROJECT: 24660MW ENCORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYNIS OF NCTPS, CHENNAI		CAD/DRAWN DESIGNED CHECKED SCALE JOB. No. DWG.No.	VIKAS SKM/SN S.K.M. N.T.S. D-4027 114-04-0108		23.04.13 23.04.13 24.04.13 0
TITLE :- INST. DRAWING FOR DIFF. PRESS. SWITCH/GAUGE/LEVEL SWITCHES FOR BID PURPOSE ONLY		SHEET No. 11 of 12			



TITLE

2X660 MW, ENNORE SEZ STPP
TECHNICAL SPECIFICATION FOR
PRE- TREATMENT PLANT

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

ANNEXURE VIII : WATER ANALYSIS

S.No.	Parameter	Unit	Value Range
1	General		
a	pH		7.94-8
b	Conductivity	millisiemens/cm	43.8-44.1
c	Temperature	Deg C	25-32
d	Turbidity and TSS	NTU / ppm	500
e	Total Organic carbon (total/ dissolved)	PPM of C	2.4-2.84
f	CO ₂	Mg/l	<2
g	TDS	Mg/l	39600-39740
h	BOD	Mg/l	10-12
i	COD	Mg/l	88-96
j	Oil & Grease	Mg/l	<10
k	Phenols	Mg/l	0.08-0.09
l	Free Residual Chlorine	Mg/l	<0.2
2	Cations		
a	Calcium	Mg/l	459-478
b	Magnesium	Mg/l	1510-1516
c	Sodium	Mg/l	10100-12000
d	Potassium	Mg/l	358-450
e	Ammonia	Mg/l	4.43-5.42
f	Strontium	Mg/l	12.9-12.4
g	Barium	Mg/l	1.55-1.58
h	Aluminum Total	Mg/l	1-1.8
i	Aluminum Dissolved	Mg/l	0.8-1.0
j	Manganese Total	Micro g/l	0.2-0.6
k	Manganese Dissolved	Micro g/l	0.1-0.2
l	Iron total	Micro g/l	220-260
m	Iron Dissolved	Micro g/l	Below detectable limit (detectable Limit : 10)
	Anions		
a	Chloride	Mg/l	18994-19194
b	Sulphate	Mg/l	3710-3949
c	Nitrate	Mg/l	136-152
d	Nitrite	Mg/l	0.46-0.62
e	Bicarbonate	Mg/l	144-148
f	Carbonate	Mg/l	Nil
g	Fluoride	Mg/l	2.64-2.8
h	Boron	Mg/l	0.14-0.17
i	Phosphate	Micro g/l	240-380



TITLE

**2X660 MW, ENNORE SEZ STPP
TECHNICAL SPECIFICATION FOR
PRE- TREATMENT PLANT**

SPECIFICATION NO.

PE-TS-412-158-A001

SECTION-IA

REV 00

j	Sulphide	Micro g/l	Below detectable limit (detectable Limit : 100)
k	Silica Dissolved	Micro g/l as SiO ₂	200-250
4	Heavy Metals		
A	Arsenic	Micro g/l	Below detectable limit (detectable Limit : 2)
B	Mercury	Micro g/l	Below detectable limit (detectable Limit : 1)
C	Cadmium	Micro g/l	120-130
D	Copper	Micro g/l	200-220
E	Nickel	Micro g/l	470-490
F	Molybdenum	Micro g/l	Below detectable limit (detectable Limit : 100)
5	Suspended Particle Size Range		
A	10 micron & above	Mg/l	Below detectable limit(detectable Limit : 10)
B	5 micron to 10 micron	Mg/l	Below detectable limit(detectable Limit : 10)
C	1 micron to 5 micron	Mg/l	Below detectable limit(detectable Limit : 10)
D	0.1 micron to 1 micron	Mg/l	20-26
	Colloidal Particle Size Range		
A	SDI (10 Minutes)	-	10-20
B	SDI (5 Minutes)	-	20-40
7	Density of sea water	Kg/ cum	1030

	TITLE 2X660 MW, ENNORE SEZ STPP TECHNICAL SPECIFICATION FOR PRE- TREATMENT PLANT	SPECIFICATION NO. PE-TS-412-158-A001
		SECTION-IA
		REV 00
P I D F R PRETREAT ENT PLANT		



	20 ENN RE SE SCTPS- SPECIFIC TECHNICAL REQUIREMENTS	SPECIFICATION NO.	
		VOLUME – II B	
		SECTION - C	SUB-SECTION -
		REV.	DATE 09.12.2014
		SHEET 1 OF	

3.00.00	E -TECHNICAL IN ESTIMATION FUNDAMENTALS
3.01.01	BHEL is carrying out detailed geo-technical investigation in the proposed cooling tower site. The sub-strata details encountered at bore holes BH-114, 115, 116, & 117 are enclosed as Annexure-1. The geotechnical data attached shall be solely for the purpose of guidance to the bidder. BHEL/owner does not take any responsibility about the accuracy and applicability of the geo-technical data furnished herewith. The onus of correct assessment/interpretation and understanding of the existing sub-strata conditions is on the bidder. Any variation in the data between the one furnished and to that found during execution of the work at site shall not constitute a valid reason in affecting the terms & conditions of this bid and the bidder shall note that nothing extra will be payable on this account. The bidder shall fully satisfy himself about the nature of sub-strata expected to be encountered including the type of foundation, ground water table and construction methodology to be adopted etc prior to the submission of the bid.
3.01.02	Detailed geo-technical Investigation report shall be made available to the successful bidder during contract engineering stage. If the bidder desires to carry out additional geo-technical investigation he/she may do so with prior information/permission of BHEL/owner at no extra cost to BHEL/owner. No extension in time schedule shall be permitted on this account. The bidder shall obtain approval on the agency for conducting geo-technical investigation work, field and laboratory testing schedule proposed by the bidder etc from BHEL/owner before undertaking the geo-technical investigation work. However, the net safe bearing capacity (SBC) of shallow foundation/ safe load carrying capacity of pile to be adopted for the design of foundations during detailed engineering shall be limited to the values mentioned elsewhere in the specification and any value of net SBC/ safe load carrying capacity of pile higher than the one indicated shall not be accepted. However, bidder shall note that the net safe bearing capacity and foundation depth/ safe load carrying capacity of pile to be adopted for design during detailed engineering stage shall be got approved by BHEL/owner.
3.02.00	Foundation System
3.02.01	round Improvement: Sub-soil profile is generally filled with ash followed by soft soil. Accordingly the cooling tower area shall be improved by installing 550mm diameter and 15m deep driven cast-in-situ compaction piles maximum up to 3d spacing center to center of the compaction piles by driving of suitable MS casing pipe (removable) having a detachable M.S.shoe (flat/conical) at the bottom and filling inside the casing pipe in layers of 800mm using 1 (sand: sand shall be as per specifications) : 2 (stone aggregate; stone aggregate shall be 50mm & down) and each layer be well compacted by dynamic compaction method (before compaction,

बीएसएल BHEL	20 ENN RE SE SCTPS- SPECIFIC TECHNICAL REQUIRE ENTS	SPECIFICATION NO.	
		VOLUME – II B	
		SECTION - C	SUB-SECTION -
		REV.	DATE 09.12.2014
		SHEET 2 OF	

	lift the casing for about 800mm from bottom and then the backfill shall be thor- oughly compacted. This procedure shall be repeated for every layer till the ground level is reached) for ground improvement of pond ash/soil deposit at desired location including all materials, equipment etc complete as per speci- fication, drawings and as directed by the engineer-in-charge. Bidder s all note t at round impro ement as descri ed s all e pro ided under coolin to er and associated structures under Bidder s scope in addition it Pile foundation.
--	---



**2 0 ENN RE SE SCTPS-
SPECIFIC TECHNICAL REQUIREMENTS**

SPECIFICATION NO.

VOLUME – II B

SECTION - C

SUB-SECTION -

REV.

DATE 09.12.2014

SHEET OF

3.02.02

pen foundations

In case open foundations are adopted for structures other than cooling tower (pile foundation is required for cooling tower) the following shall be adhered to in addition with necessary ground improvement.

i. Minimum width of foundation shall be 1m.

ii. Minimum depth of foundation shall be 2.00m below ground level. Net safe bearing capacity of open foundation resting at pond ash/soil deposit shall be restricted to 10T/sqm with necessary ground improvement as mentioned elsewhere. Any value of net SBC higher than the one indicated above will not be accepted. However, the bidder shall note that the net safe bearing capacity and foundation depth to be adopted for design during detailed engineering stage shall be got approved by BHEL/owner

iii. It shall be ensured that all foundations of a particular structure/ building/ equipment shall rest on one bearing stratum, i.e. either over burden or rock.

iv. The permissible settlement as mentioned under para “permissible settlement of foundations” or the permissible settlement from functional requirements whichever is more stringent shall be adopted for the design.

v. Permissible settlement of foundations:

The permissible total settlement and differential settlement of foundation resting on soil mass shall be governed by IS: 1904 and from functional requirements whichever is more stringent. However, the total settlement of foundation resting on ash/soil shall be restricted to 25mm and to that on rock shall be restricted to 12mm.

vi. Analysis and proportioning of footings to minimize differential settlements shall be carried out for all major foundations and the same shall be submitted for BHEL/owner's approval.

Pile foundations.

3.02.03

In case pile foundations are adopted then the following shall be strictly adhered to.

1. The pile foundation shall be of bored cast-in-situ RCC piles as per IS: 2911 part-1 section-2. Three stages flushing of the pile bore shall be ensured as per the methodology duly approved by BHEL/owner. The construction methodology to be adopted shall be suitable to ensure proper termination of pile in the strata as specified elsewhere and to ensure pile bore free from spoils.



**2 0 ENN RE SE SCTPS-
SPECIFIC TECHNICAL REQUIREMENTS**

SPECIFICATION NO.

VOLUME – II B

SECTION - C

SUB-SECTION -

REV.

DATE 09.12.2014

SHEET 4 OF

2. Only RCC piles shall be provided.
3. Minimum diameter of pile shall be 600 mm.
4. Length of pile shall be 25m below cut off level. Cut off level shall be minimum 4m below ground level.
5. The allowable load carrying capacity of the pile in vertical compression shall be limited to its structural capacity. However, the pile capacities to be adopted shall be the least of the estimated design value and that obtained from the pile load test. Maximum permissible lateral deflection at pile head shall be 5mm.
6. Only straight shaft piles shall be used.
7. Minimum cover to main reinforcement in the pile shall be 75mm.
8. The piling work shall be carried out in accordance with the provisions of IS: 2911 (relevant part) and approved construction methodology. Minimum grade of concrete shall be M-35 with cement content not less 360 Kg/cu.m shall be adopted for piling.
9. Cement to be used for entire NDCT structure including pile cap is sulphate resistant cement with C3A content between 5 to 8%.
10. Reinforcement shall conform to grade Fe 500/550 as per IS: 1786 except noted otherwise. Fusion bonded epoxy coated reinforcement steel, with coating conforming to IS: 13620 shall be used for entire NDCT structure including pile and pile cap.
11. As per IS 456, the environmental exposure condition of “very severe” shall be considered for entire NDCT structure below & above ground level including pile cap & Pile. Also, requirement of table 4 & 5 of IS 456 shall be satisfied depending on exposure condition.
12. The actual length of pile shall in no case be less than the design length. However, the safe load carrying capacity for Diameter piles shall be limited to the following Table-1 with necessary ground improvement as mentioned elsewhere.



**2 0 ENN RE SE SCTPS-
SPECIFIC TECHNICAL REQUIREMENTS**

SPECIFICATION NO.

VOLUME – II B

SECTION - C

SUB-SECTION -

REV.

DATE 09.12.2014

SHEET 5 OF

Table-1

For Bored Cast In situ RCC piles:

S. No	Pile dia (mm)	Pile capacity in vertical (MT)	Pile capacity in lateral (MT)	Pile capacity in Uplift (MT)
1	600	135	6.7	35
2	750	200	8.4	50
3	900	270	10	65

13. Bidder shall furnish the design of piles (in terms of rated capacity, length, diameter, termination criteria to locate the founding level for construction of pile, reinforcement for job piles and test piles etc.), construction methodology/ specification for construction of piles and scheme of initial pile load tests in vertical, lateral and uplift load carrying capacities for BHEL/owner's approval. The bidder shall submit the proposed location of initial test piles for BHEL/owner's re-view and approval prior to installation.

14. The geotechnical data available is enclosed for reference.

15. Regular quality assurance checks for density of circulation mud, contamination mud and samples from pile bore bottom, slump of concrete, pile concrete integrity etc. shall be done by the bidder

16. The dynamic cone penetration tests shall be carried out for a depth of at least 2 meters from the termination depth. One number dynamic cone penetration test for each pile group consisting of more than four piles.



**2 0 ENN RE SE SCTPS-
SPECIFIC TECHNICAL REQUIREMENTS**

SPECIFICATION NO.

VOLUME – II B

SECTION - C

SUB-SECTION -

REV.

DATE 09.12.2014

SHEET OF

3.02.03 Pile Load Tests

Bidder shall install the piles for initial load test. Minimum number of initial load tests to be performed for each diameter and rated capacity of pile shall be as under.

- | | |
|---------------------------|---|
| 1. Vertical (compression) | 3 |
| 2. Lateral (horizontal) | 3 |
| 3. Uplift (tension) | 3 |

The initial pile load test shall be conducted up to a maximum test load of three times the estimated safe load carrying capacity of pile. In case of compression test, the method of loading shall be cyclic as per IS: 2911 ((relevant part).

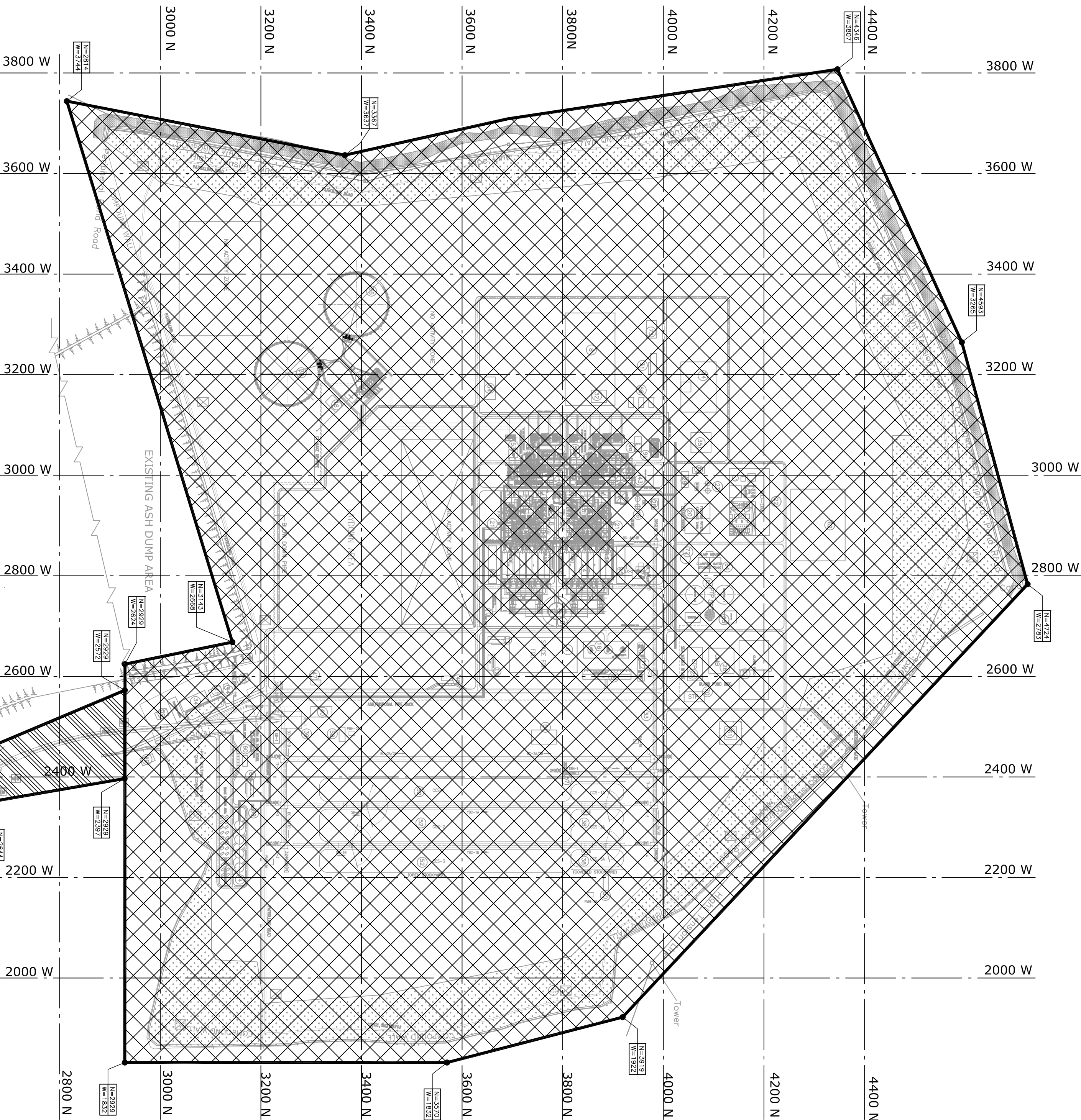
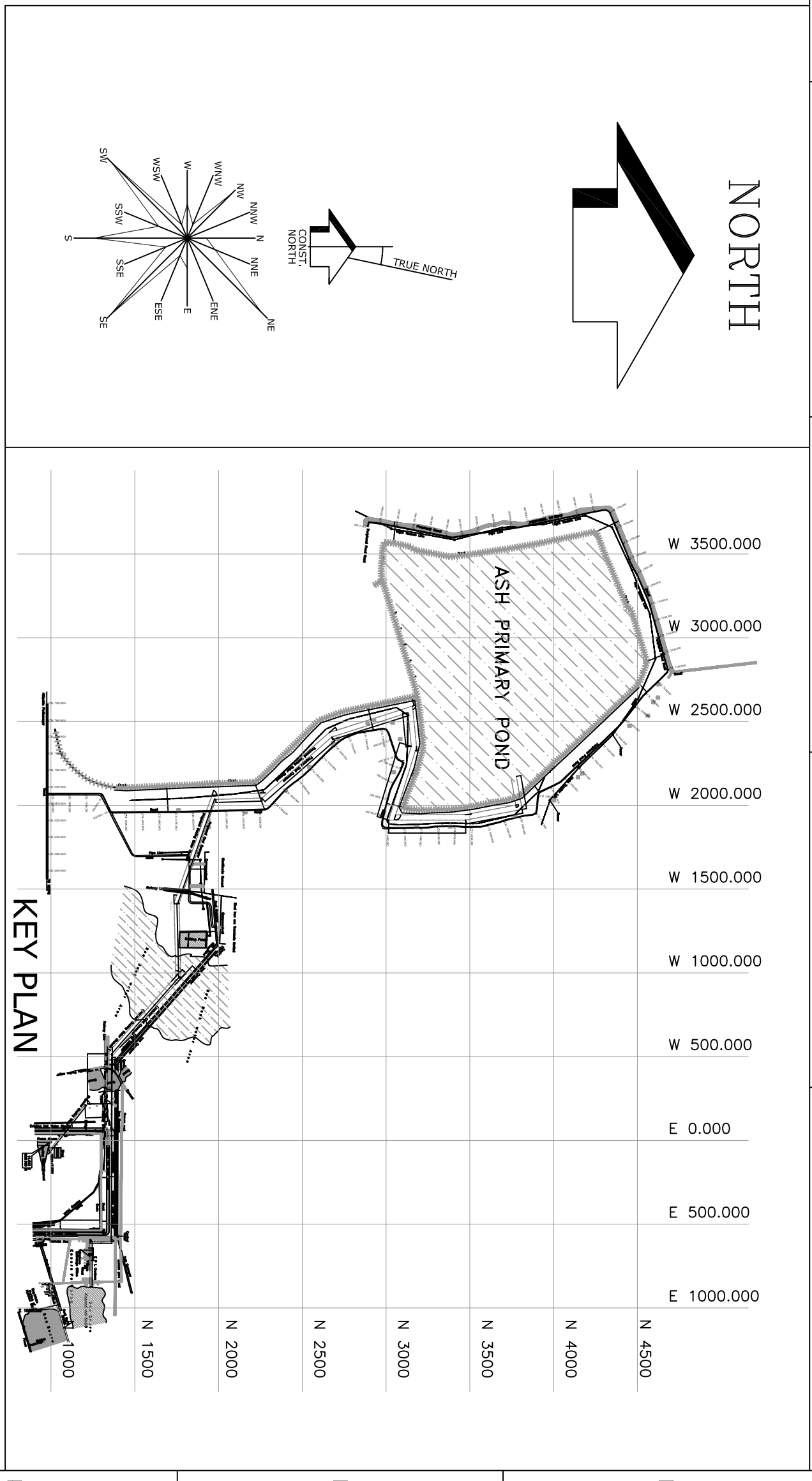
The routine load test on piles shall be conducted upto a maximum test load of one and half times the allowable pile capacity as per relevant Indian Standards. Number of routine pile load tests to be performed for each diameter/ allowable capacity of pile in vertical compression and lateral load shall be at least 1.5% of total number of job piles in each case. Piles for routine load test shall be approved by BHEL/owner

Testing of piles and interpretation of pile load test results shall be carried out as per IS: 2911, Part-4. Bidder shall ensure that all equipments/ instruments are properly calibrated at a reputed laboratory/institution prior to their use and the calibration test certificates shall be submitted to BHEL/owner.

A report on the pile load tests shall be submitted for BHEL/owner's approval In case, routine pile load test shows that the pile has not achieved the desired capacity or pile (s) have been rejected due to any other reason, then the bidder shall install additional pile(s) as required and accordingly pile cap design shall be reviewed and modified if required at no extra cost to BHEL/owner.

3.02.04 Pile Integrity Test:

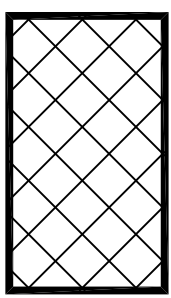
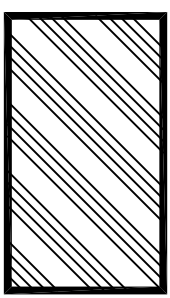
Low strain pile integrity test shall be conducted on all job piles. The test equipment shall be of TNO or PDI make or equivalent. The process shall confirm to ASTM.

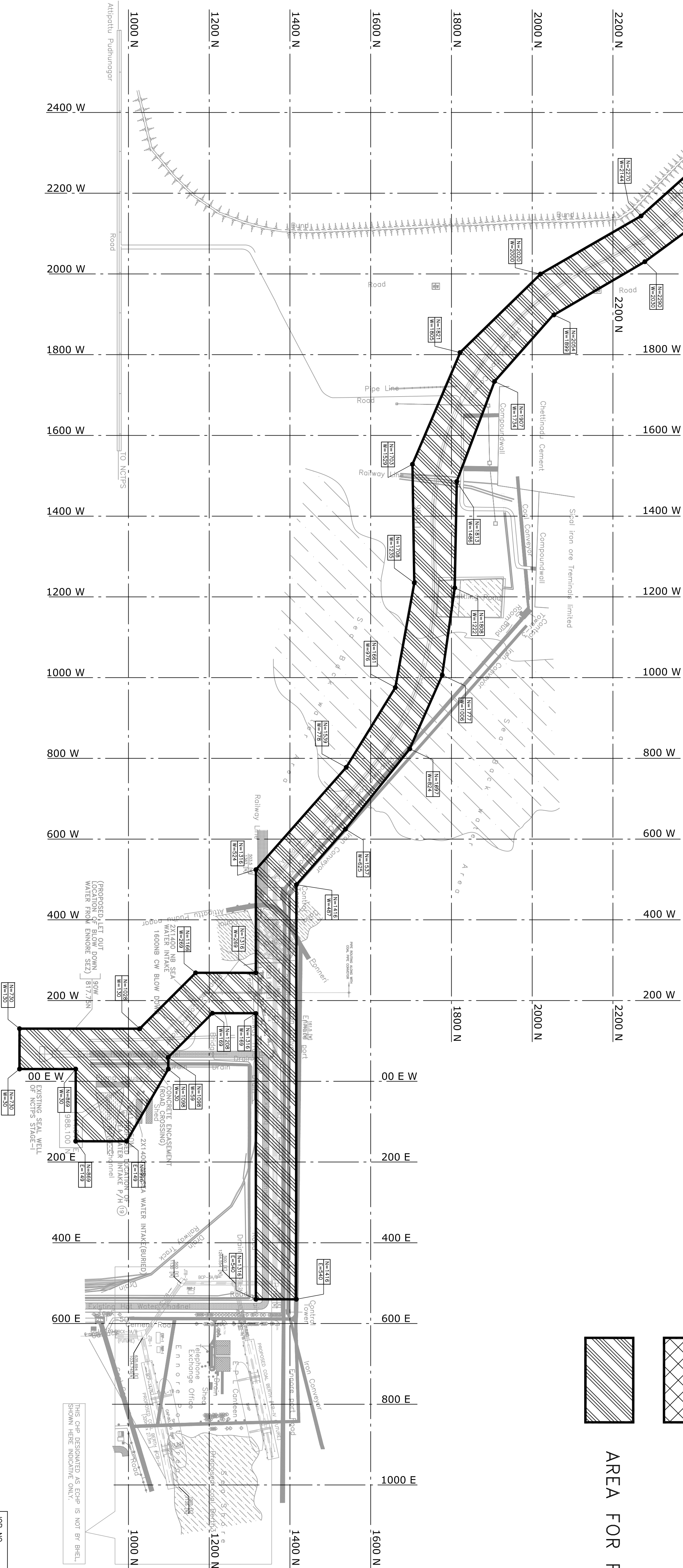


- NOTES:-**
1. ALL DIMENSIONS ARE IN METER.
 2. TOPOGRAPHICAL SURVEY SHALL BE CARRIED OUT AS PER SPECIFICATION NO. PE-DC-412-601-C001.
 3. LOCATION OF BENCH MARK PILLAR/GRID PILLAR SHALL BE SUITABLY DECIDED AT SITE IN CONSULTATION WITH CUSTOMER/ENGINEER-IN-CHARGE.

REFERENCE DRAWING:-
DRAWING NO. PE-DC-412-100-M001, REV-RO "PLOT PLAN (INCLUDING OUTSIDE PLANT BOUNDARY)".

LEGEND:-

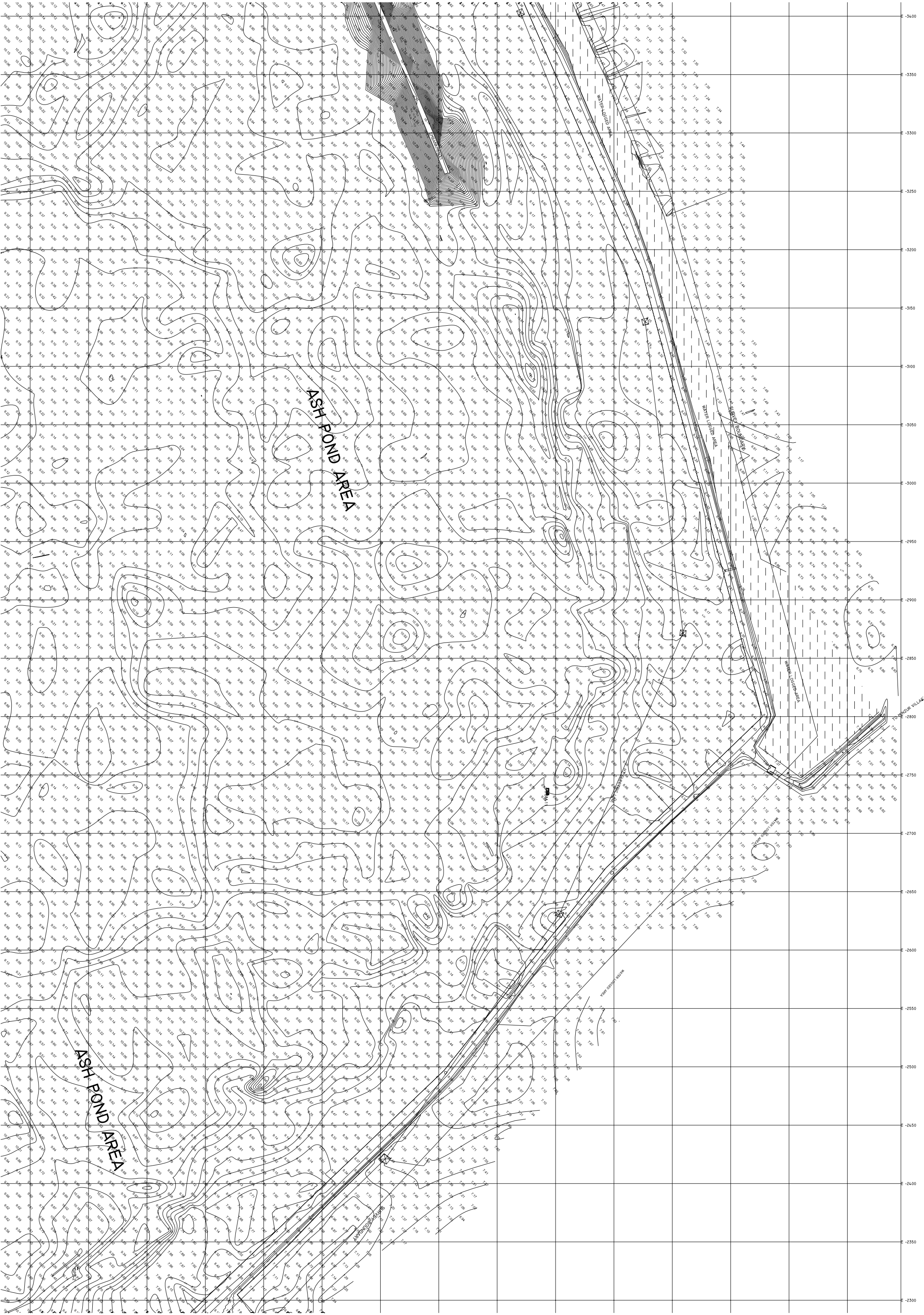
-  **AREA FOR TOPOGRAPHICAL SURVEY**
-  **AREA FOR ROUTE SURVEY**

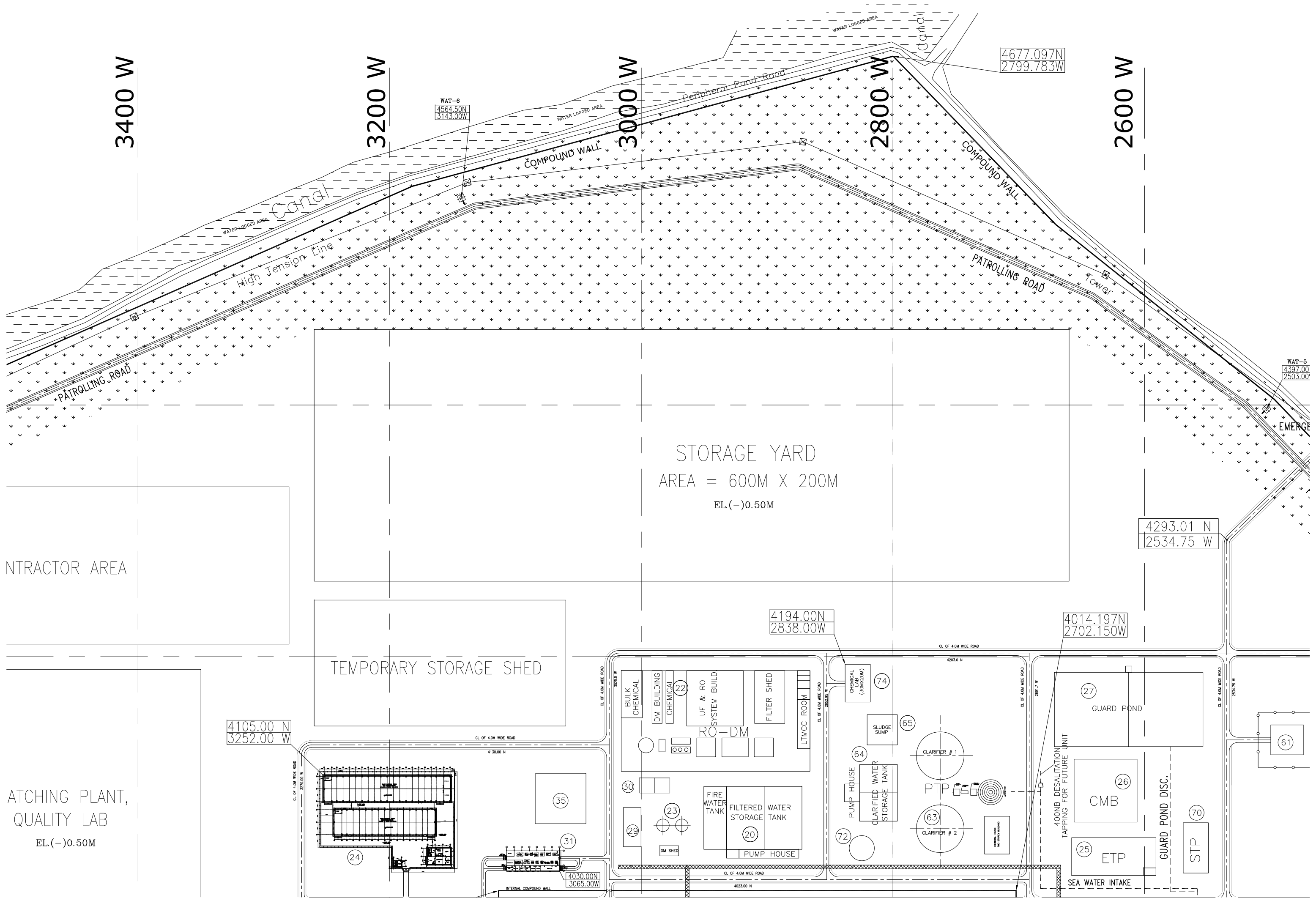


BHEL - PROJECT ENGINEERING MANAGEMENT	
THIS DRAWING (WORK/CL) IS RELEASED FOR:	
☐	COMMENTS / APPROVAL
☐	PLANNING / REGISTRATION
☐	CONSTRUCTION
SIGNATURE: _____	
NAME: _____	
DATE: 05.12.2014	

PROJECT		2x660 MW ENNORE SEZ COAL BASED STPP	
AT ASH DYKE OF NCTPS, CHENNAI			
CUSTOMER		TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)	
DESIGNER		BHARAT HEAVY ELECTRICALS LTD	
PROJECT ENGINEERING MANAGEMENT		NEW DELHI	

JOB NO.		412	
STATUS		CONTRACT	
DISTRIBUTION			
REQ.	DATE	ALLO.	CHG.
REQ.	DATE	ALLO.	CHG.
REQ.	DATE	ALLO.	CHG.





SCHEDULE FOR CONCRETE RCC AND REINFORCEMENT STEEL						
2X660 MW, ENNORE SEZ STPP						
PRE TREATMENT PLANT						
Sl.No	DESCRIPTION OF EQUIPMENT / ITEM					
1	2					
	Description			QT	Unit	
1.0	Total Quantity of all Concrete RCC works required for entire Pretreatment plant (except Chemical house Building)				CuM	
2.0	Total Quantity of all Reinforcement steel required for entire Pretreatment plant (except Chemical house Building)				MT	
Notes :-						
1. Bidders Total price shall be determined after adding cost of Concrete & reinforcement Steel at following rates in his total quoted prices. a) Concrete RCC – Rs. 5560 per cum b) Reinforcement steel – Rs. 66762 per MT						

REPLY OF PRE-BID QUERIES

SL NO.	VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATIONS	REASON FOR CLARIFICATIONS	BHEL REPLIES
1	PE-TS-412-158-A001	SECTION-IA	1.5	16	TERMINAL POINT a) Raw water: 20m from Aerator central shaft at 0.5m above FGL.	We excluded the piping from the raw water pumps to pretreatment plant	As per the termination point, the scope starts at 20m from the aerator. Hence we will consider the same.	Please follow tender specification.
2	PE-TS-412-158-A001	SECTION – A PROJECT INFORMATION SECTION-IA Annexure VIII	1.10.1	6 140 & 160	1.10 Source Of Water 1.10.1 Source The raw water intake shall be from the existing cooling water forebay of NCTPS PHASE-II. Annexure VIII	Please clarify the source of water. We understand that the same is Sea water as per Annexure VIII. Please confirm our understanding	As per the tender, the pretreatment plant need to be designed for Annexure VIII. However source of water is written as "The raw water intake shall be from the existing cooling water forebay of NCTPS PHASE-II."	Bidder to refer Amendment-1.
3	PE-TS-412-158-A001	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	1.1 & 1.5	12	iii. Piping along with valves from raw water supply pumps to aerator as per flow diagram enclosed for pre-treatment plant. 1.5 TERMINAL POINT	We understand that the feed water will be given 20m from the cascade aerator as per termination point.	As per termination point the feed water will be given 20m from the cascade aerator at 0.5 m above FGL	Please follow tender specification.
4	PE-TS-412-158-A001	SECTION-IA 1.1 PRE TREATMENT PLANT (PT PLANT)	1.1	12	vi. Clarifier bridge (half bridge mechanism) assemblies with VFD drive, hand railings, required motors, valves, piping, instrumentation etc as per P & ID enclosed for pre-treatment plant.	Please note that VFD is offered only in reactor type clarifier (HRSCC). The clarifier proposed is clariflocculator, hence VFD is not required for the same. Please confirm our understanding.	The clarifier type proposed is clariflocculator hence no requirement of varying the speed. Clariflocculator works on constant drive speed.	Please follow tender specification.
5	PE-TS-412-158-A001	SECTION-IA 1.1 PRE TREATMENT PLANT (PT PLANT) Broad scope of supply	1.1	13	ix. Three (3) nos. sludge transfer pump with electric motor drive, piping, valves, fittings and instrumentation upto guard pond. The distance between Guard pond and PT plant is 350m.	Please clarify the scope of piping up to the guard point. If the same is in bidder's scope, please clarify the pipe routing and whether the same is above ground (on supports) or underground piping. And also please confirm the MOC of the sludge pipe. As per the tender P&ID same is written as Duplex SS which is very much costly and normally HDPE/GRP is suitable.	Scope and Routing of the piping is not clear in the tender	Bidder to refer Amendment-1.
6	PE-TS-412-158-A001	SECTION-IA 1.4 SCOPE OF SERVICE	1.4	13	m) Painting of all equipment within scope of supply as per Annexure V. Final touch up painting at site.	Any painting/ lining required on RCC/ Civil units shall be in the scope of purchaser. Painting on only the bidder supplied equipment is in the scope of bidder	Scope of painting on civil/RCC structures are not clear.	Please follow tender specification.
7	PE-TS-412-158-A001	SECTION-IA 1.26 CIVIL DESIGN EVALUATION CRITERIA	1.26	23	1.26 CIVIL DESIGN EVALUATION CRITERIA: a) For all the civil works for which civil design is in Bidder's scope evaluation shall be done for the total concrete & reinforcement quantity quoted by the Bidder. The bids will be evaluated based on the Pre treatment plant prices quoted by the bidder and quantities of reinforcement steel and concrete used in the Pre treatment plant (except Chemical house) quoted by the bidder.	We understand that the over head water tank is part of chemical house as it is located on the top of the chemical house. Hence same will not be considered in the civil quantities which will be quoted.	The over head water tank is part of chemical house as it is located on the top of the chemical house.	Noted.
8	PE-TS-412-158-A001	SECTION-IA	1.1 iii 1.1	12 164	BROAD SCOPE OF SUPPLY ii. Raw water inlet piping to aerator complete with piping, fitting and valves. The inlet piping is to include two number motorized butterfly type control valves with necessary manual isolation/ control valve and necessary instrumentation. DATA SHEET FOR PRETREATMENT PLANT 1.0 INLET VALVES One (1) number motorized butterfly flow control valve, located at inlet to aerator, with manual upstream and downstream isolation valves along with bypass manual butterfly flow valve.	Please clarify the no of motorised butterfly valve to be provided in the control valve station.	As per the broad scope of supply and P&ID the 2 Nos of motorized valves are to be provided. However as per the data sheet for pretreatment 1 no. motorised butterfly flow control valve is to be provided	Bidder to refer Amendment-1.
9	PE-TS-412-158-A001	SECTION-IA		164	DATA SHEET FOR PRETREATMENT PLANT 6.0 CLARIFLOCCULATOR 6.5 Side Water Depth (SWD) Minimum 4.5 meter.	Please clarify the SWD need to be provided for Clariflocculator.	Please note that the normally the SWD of the clariflocculator varies from 3m to 4m. Only in HRSCC/ Reactor type clarifier the SWD used to be 4 - 4.5.	Please follow tender specification.
10	PE-TS-412-158-A001	SECTION-IA		166	DATA SHEET FOR PRETREATMENT PLANT 19.4 NaOCl DOSING SYSTEM FOR POTABLE WATER (@ 2 ppm)**	As the dosing point is not in the scope of bidder please clarify the dosing point of NaOCl dosing.	Potable water line is not in the scope of bidder.	Bidder to refer Amendment-1.

11	PE-TS-412-158-A001	SECTION-IA Chapter 4		167 198	20.1 Sludge transfer pump - lubricated. 500 CuM/Hr. (each) - 3 x100% 10.0 Sludge Disposal Pumps c. Capacity rate Cum/hr Minimum 1000	Please clarify the capacity of the sludge transfer pump. We understand the same is to be 500 m3/hr (1W+2S). If the pump capacity is 1000 m3/hr, we can not give the power guarantee of < 100 KW as per ANNEXURE III: FUNCTIONAL GUARANTEES AND LIQUIDATED	As per Section IA data sheet it is 500 m3/hr(3x100%). However as per the Chapter 4 data sheet the same is 1000 m3/hr (2W+1S)	Bidder to refer Amendment-1.
12	PE-TS-412-158-A001	SECTION-IIA	1.3	190	1.3 CLARIFIERS v) The clarifier unit shall be circular, central feed type with concentric recirculation zone (rapid mixing) with sampling points at different elevation, reaction zone (slow mixing) and clarification zone in RCC construction. vi) Bridge type rake arm and suitable equipment such as turbine/ impeller shall be provided for internal sludge recirculation	Please note that the requirement is for clariflocculator. Hence there will not be any recirculation zone (rapid mixing) and turbine.	Tender requirement is for clariflocculator where there will be feed well, reaction zone (with Flocculation drive and impeller) and clarification zone as specified in Section IA data sheet.	Noted.
13	PE-TS-412-158-A001	Chapter 4		194	4.3 Pretreatment & Filtration Plant g) Coagulant (Alum) Dosing system consisting of 2 nos. dosing tank and 2 x 100% capacity dosing pumps complete with associated piping and valves.	Please confirm the type of coagulant (Alum or FeCl3) and the number of the coagulant dosing tanks.	Please note that as per the section IA and P&ID the no of coagulant (FeCl3) dosing tank is 3 Nos And as per Chapter 4 the same is 2 Numbers.	Bidder to refer Amendment-1.
14	PE-TS-412-158-A001	Chapter 4		195	l) One (1) complete sludge handling system consisting of reject sump of 2000 cum. effective capacity, three(3) nos. vertical sludge pumps (2Working + 1 Standby), each of 1000 cum/hr capacity , sludge flushing arrangement etc.	Please clarify the capacity of the sludge holding tank. We understand that the same is 600 m3 (300 m3 x 2 Compartment)	As per Section IA the Sludge sump capacity is 600 m3 (300 m3 x 2 Compartment)	Bidder understanding is correct.
15	PE-TS-412-158-A001	Chapter 4		195	p) Necessary flushing arrangement for the filter back wash water disposal pipes. q) Two nos. (1W+1S) twin section dual media filters with inlet channels, flow controller, filter media, internals complete with associated piping and valves. r) Seven nos (6W+1S) Ultra filter modules complete with filter media, internals complete with associated piping and valves. Backwash provision of the UF shall consist of UF backwash pumps 2(1W+1S), dosing skids with dedicated pumps 2(1W+1S). Filter backwash from the filter outlet shall also be led to guard pond. s) One (1) no. RCC UF Permeate Water Storage tank of effective capacity 2000 cum in two compartments. Tank shall be covered. t) Seven (6W +1S) Cartridge filters. u) 3 x 50% Cartridge Filter Feed Pumps. v) 2 x 100% UF Backwash Pumps w) Other civil works as specified	We understand that same is not in the scope of bidder.	Tender spec requirement is for only pretreatment plant.	Bidder to refer Amendment-1.
16	PE-TS-412-158-A001	Chapter 4		228	10.02.00 Initial Operation b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours	We understand that the same clause is not applicable for the pretreatment package. The time duration for precommissioning, commissioning, trial run, PG test till handing over shall be 7 - 15 days (168hrs to 360 hrs).	Tender spec requirement is for only pretreatment plant.	Please follow tender specification.
ELECTRICAL AND INSTRUMENTATION								
1	PE-TS-412-158-A001	SECTION-IA-Rev 00	1.13	19	Vii. Provisions for data transfer with reference to important parameters related with Pre Treatment Plant to DCS shall be made through soft link through OPC on Fiber optic.	We understand that we have to provide port in PLC, any cable required (Soft or hard) between PLC to DCS Shall be in BHEL/Other Scope as per PLC Configuration drawing . Kindly clarify our understanding	For better clarity	Bidder to refer Amendment-1.
2	PE-TS-412-158-A001	SECTION-IA-Rev 00	1.0.0	116	ANNEXURE VI : MANDATORY SPARES LIST	List of Mandatory spares for Instrumentations shall be only for Supplied items,However Qty shall be as mentioned in Mandatory Spares.	Annexure VI Mandatory spare List items is exhaustive which includes the system which are not in bidder's scope.	Bidder to refer Amendment-1.
3	PE-TS-412-158-A001	SECTION-IB-REV 00	3	174	3.Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope-by BHEL b) both end equipment in vendor's scope-by BHEL c) one end equipment in vendor's scope-by BHEL	As per this scope matrix we understand that Screened cables (inst cable) shall in Client/BHEL Scope. Kindly clarify our understanding	Power cables, control cables and screened control cables between both end equipment in vendor's scope shall be supplied by BHEL	Please follow tender specification.
4	PE-TS-412-158-A001	SECTION-IC-REV 00	4	180	4. Remote I/O panels with push buttons, indication lamps and annunciation shall be provided for subsystems where manned local operation is required.	As per Control philosophy All motors/ Inst/ Valves are operated from PLC Located in Chemical Room. Hence no Remote I/O panels envisage for supplied PT plant as all the sub-systems are located with in battery limit . Kindly Confirm the same	PLC Located with in PT area (Chemical House). And also there is no requirement mentioned in Section IA,	Bidder to furnish as per Amendment-1. .

5	PE-TS-412-158-A001	SECTION-IC-REV 00	13	181	13. UPS for PLC & OWS shall be in bidder's scope with 2X100% configuration. UPS shall have 2X100%, Ni-Cd type battery bank with 60 min back up. Battery Health Monitoring System (BHMS) shall be provided.	As Per UPS Scheme 1x100% Ni-Cd Battery required and Single set of batteries required for load less than 15KVA, Hence based on that we have Considered 1x100% capacity batteries. Kindly confirm the same.	For better clarity	Bidder to furnish as per Amendment-1.
6	PE-TS-412-158-A001	SECTION-IC-REV 00	18	182	18. Bidder shall provide the necessary hardware & software required for connecting the PLC system to Bidder's remote service centre, through which the diagnostics & fault analysis of the PLC system can be carried out. The method of connection shall be as per Bidder's standard practice. However, it is preferred to have the connection through a single point in the PLC system.	Please note that we did not envisage any remote service centre in our scope of supply.	Offered PLC system shall be as per system architecture drawing. No remote service centre required for the offered PLC.	PLC not Applicable. Bidder to refer Amendment-1.
7	PE-TS-412-158-A001 Vol-V : CE/C/P&E/EE/E/OT.No.03/ 2013-14	SECTION-IC-REV 00 SECTION-IIC-REV 00	36	184 498	36. In case of sea Water applications, material of Instrument's wetted parts, impulse pipes, impulse tubes, erection hardware, fittings, sampling pipes, tubes, fittings, and all type of erection hardware etc. shall be "super duplex SS" suitable for sea water. L : Drawing Hook up drawing for transmitters and other instruments impulse tubing, valves manifolds, tubing other hardware SS 316	Please note that there is contradiction between these two statements regarding MOC for fittings. We have considered SS 316/SS316L Material for same as per process requirement. Kindly confirm the same	As per instrument drawing for Transmitters & other material	MOC of impulse tubing & impulse pipe shall be CPVC (3/8") Sch 80 or better, Industrial grade up to manifold. MOC of impulse tubing, fittings (from manifold to instrument) and manifold shall be super duplex SS in case of sea water applications. Bidder to refer Amendment-1.
8	PE-TS-412-158-A001	SECTION-IC-REV 00		186	PLC Configuration drawing for pretreatment 9) redundancy of I/O Shall be as per Specification requirement	Redundancy Shall be provided for AO & DO . Kindly confirm the same	As per process requirement	PLC not Applicable. Bidder to furnish as per Amendment-1.
9	PE-TS-412-158-A001	Chapter 10	10.4.2	266	Two (2) nos. redundant ultrasonic type level transmitter (2 Nos.) with limiter technique shall be provided for alarming, auto start & auto stop. along with necessary junction box, local control panel, control cables etc. to achieve automatic starting/stopping of the sump pumps, and also ON/OFF indication for sump pump shall be monitored at DDC system. The entire assembly being mounted on the same base frame as mentioned above (item "b"). The control panel shall also be equipped with start/stop push button for starting/stopping individual sump pumps manually. Local control panel and cable shall be as per requirements described else where in the specification.	Not Applicable for Supplied PT plant. Kindly confirm the same	Sump pumps mentioned are not in the scope of bidder. Hence the same is excluded.	Two (2) nos. level transmitters have been provided at Sump but not at sump pumps (Refer PID of PTP). Bidder to furnish as per Amendment-1.
10	PE-TS-412-158-A001	Chapter 10	10.4.3	267	e) Sump Pump Motors : A starter panel complete with incoming switch/contact, fuse, overload relays, start-stop push button, O/L reset push button, cable gland, wiring terminals, red and green indication lamps (LED type), necessary control cables etc., and also 50 metres length of flexible power cable with power plug at one end and arrangement to connect the other end with the starter panel.	Not Applicable for Supplied PT plant. Kindly confirm the same	Sump pumps mentioned are not in the scope of bidder. Hence the same is excluded.	Two (2) nos. level transmitters have been provided at Sump but not at sump pumps (Refer PID of PTP). Bidder to furnish as per Amendment-1.
11	Vol-V : CE/C/P&E/EE/E/OT.No.03/ 2013-14	SECTION-IIC-REV 00	General	317	3. RTU have been envisaged for data acquisition function. Bidder shall provide RTUs comprising of Input /Output modules, Processor etc, Signal cable for interface with PLC panel.	As per Control philosophy All motors/ Inst/ Valves are operated from PLC Located in Chemical Room, Hence no RTU panels envisage for supplied PT plant. Kindly Confirm	Sec IIC is general specification Document which is applicable for complete power plant.	PLC not Applicable. Bidder to furnish as per Amendment-1.
12	Vol-V : CE/C/P&E/EE/E/OT.No.03/ 2013-14	SECTION-IIC-REV 00	General	318	iii. In addition Hardwired signal interfacing shall also be provided for any signal required for interlock/control protection, similarly cable for hardware signal transfer between DDCMIS and PLC/relay based control system shall be supplied, laid terminated by the bidder including preparation of cable schedule.	Any cable outside PLC shall be in BHEL scope. Kindly confirm the same.	As per PLC Architecture drawing & Electric Scope matrix, connectivity to DDCMIS is not in the scope of bidder. Sec IIC is general specification Document which is applicable for BTG power plant.	PLC not Applicable. Bidder to furnish as per Amendment-1.
13	Vol-V : CE/C/P&E/EE/E/OT.No.03/ 2013-14	SECTION-IIC-REV 00	3.03.01.01	331	Transmitters & other HART based instruments shall be supplied along with 3 Nos. of universal type hand held/portable pressure calibrators. Temperature transmitters shall be supplied along with 3 Nos. of hand held/portable mV source generators.	We have not offered any temperature transmitter required in the PT plant, Hence hand held/portable mV source generators is not applicable for pretreatment plant.	For better clarity	All transmitters shall be HART compatible. Bidder to refer to amendment-1. .
14	Vol-V : CE/C/P&E/EE/E/OT.No.03/ 2013-14	SECTION-IIC-REV 00	3.03.23	338	Flow Transmitter (Ultra Sonic) : Out put : 4-20 Ma with HART Protocol Display : Head mounted LCD Display and remote LCD display	Please note that HART protocol available with out Head mounted LCD Display as per manufacture standard, Hence we have considered 4-20ma signal to PLC to control MOVs with Local LCD Display.(HART+Local display combination not Available/possible) Kindly Confirm the same	For better clarity	All transmitters shall be HART compatible. Bidder to refer to amendment-1.

15	Vol-V : CE/C/P&E/EE/E/OT.No.03/ 2013-14	SECTION-IIC-REV 00	4.02.1	375	31.All the 4 nos. 40" LED TV monitors per unit and 2 nos 40" LED TV monitors for common system at CCR shall be erected at the false roof top of central control room.	Our scope of supply for monitors shall be as per PLC configuration Architecture drawing for PT plant. Kindly confirm the same	Sec IIC is general specification Document which is applicable for BTG power plant.	Bidder to refer Amendment-1.
16	Vol-V : CE/C/P&E/EE/E/OT.No.03/ 2013-14	SECTION-IIC-REV 00	4.02.06.2	379	F) Dual /Triple redundance sensors shall be provided when used in protection circuits for critical equipments and 2 out of 3 logics shall be derived for further use in protection circuit	Please note that we do not envisage any dual/triple redundancy sensors or 2 out of 3 logics as there are no critical equipment in the offered PT Plant.	Sec IIC is general specification Document which is applicable for BTG power plant.	Bidder to refer Amendment-1.
17	Vol-V : CE/C/P&E/EE/E/OT.No.03/ 2013-14	SECTION-IIC-REV 00	4.02.07.05	384	System shall have capability to add any new control loop in CLCS and new group ,sub group,drive functions in OLCS while existing system is fully operational. Intelligent I/O cards will be preferred.	PLC Shall be provided with Microprocessor based Controller ,Hence intelligent I/O cards is not required in our scope of supply.	Sec IIC is general specification Document which is applicable for BTG power plant.	Bidder to refer Amendment-1.
18	Vol-V : CE/C/P&E/EE/E/OT.No.03/ 2013-14	SECTION-IIC-REV 00	4.02.08.02	386	4.02.08.02 Redundancy In Input /Output Modules : Hot Standby 100% redundancy shall be provided for all Input/output cards where Inputs/Outputs are used for CLCS and OLCS. all Input/Output of scada from/to breaker & isolation shall be redundant. No redundancy at I/O card level is required which are executing purely data acquisition/Monitoring function	We understand that redundancy at I/O Module level is not require for pretreatment. Kindly confirm the same	Sec IIC is general specification Document which is applicable for BTG power plant.	Bidder to refer Amendment-1.
19	PE-TS-412-158-A001	SECTION-IA-REV 00	Annexure II	49	Customer vendor List BHEL Vendor list (PEM register vendor)	In Case if there is contradiction between these two vendor list,then preferred vendor shall be BHEL vendor list. Kindly confirm the same.	Duplication of Instrument Make occurred in list	Bidder to refer Amendment-1.
20	PE-TS-412-158-A001	SECTION-IA-REV 00	Annexure II	68	5. PLC Make : GE,Siemens,Rockwell Automation,Schneider, Honeywell	We understand that PLC from system integrator and not from OEMs. Kindly confirm the same.	Quantity of I/Os are very less,Hence OEMs are intrested for quoting	Bidder to refer Amendment-1.
21	PE-TS-412-158-A001	SECTION-IA-REV 00	Annexure II	88	ULTRASONIC FLOW METERS-NIVUS GMBH	We request to include Electronet,Forbes marshall, ABB, E&H, Emerson,Adept etc	Only single make provided in the vendor list for ultrasonic Flow transmitter	Bidder to refer Amendment-1.
CIVIL								
1	PE-TS-412-158-A001	SECTION - IA SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	1.4 SCOPE OF SERVICE	15	a) Design and engineering of entire Pretreatment plant. b) Complete civil design of Entire Pretreatment plant (excluding Chemical house building).	Please provide contour map for proposed site	As bidder need to quote total concrete & reinforcement quantity, please provide contour map for proposed site which is required for designing and estimation of above.	Bidder to refer Amendment-1.
2	PE-TS-412-158-A001	1.26 CIVIL DESIGN EVALUATION CRITERIA:		23	a) For all the civil works for which civil design is in Bidder's scope evaluation shall be done for the total concrete & reinforcement quantity quoted by the Bidder. The bids will be evaluated based on the Pre treatment plant prices quoted by the bidder and quantities of reinforcement steel and concrete used in the Pre treatment plant (except Chemical house) quoted by the bidder.	Please provide detailed geotechnical report for the proposed plant location. To enable us to bid competitive offer.	As bidder need to quote total concrete & reinforcement quantity, please provide contour map for proposed site which is required for designing and estimation of above.	Bidder to refer Amendment-1.
3	PE-TS-412-158-A001	1.26 CIVIL DESIGN EVALUATION CRITERIA:		23	a) For all the civil works for which civil design is in Bidder's scope evaluation shall be done for the total concrete & reinforcement quantity quoted by the Bidder. The bids will be evaluated based on the Pre treatment plant prices quoted by the bidder and quantities of reinforcement steel and concrete used in the Pre treatment plant (except Chemical house) quoted by the bidder.	Please provide the natural ground level.	As bidder need to quote total concrete & reinforcement quantity, please provide contour map for proposed site which is required for designing and estimation of above.	NGL SHALL be as contour plan. Also, FGL for entire plant is 9.5 m.
4	PE-TS-412-158-A001	SECTION - IID GENERAL TECHNICAL REQUIREMENT (CIVIL)	2.03.00	538	2.00.00 SCOPE OF CIVIL & STRUCTURAL WORKS: All materials including cement, reinforcement steel, structural steel etc. shall be arranged by the Contractor.	We excluded supply of material from our scope.	As per CIVIL SCOPE, Total Civil construction work at site is in BHEL's Scope of work. Hence there is no material to be supplied by bidder.	Noted. However, grouting material for fixing of equipment shall be in scope of bidders.
5	PE-TS-412-158-A001	SECTION - IIA GENERAL TECHNICAL REQUIREMENT (MECHANICAL)	2	191	The system shall be designed so that the Top water level in the clarified water distribution chamber shall be at least 4 M from the finished ground level or higher	Please provide the natural ground level.	We need to know that, proposed plant site is in filling area or in cutting area	NGL SHALL be as contour plan. Also, FGL for entire plant is 9.5 m.
6	PE-TS-412-158-A001	SECTION - IIA GENERAL TECHNICAL REQUIREMENT (MECHANICAL)	2	191	The system shall be designed so that the Top water level in the clarified water distribution chamber shall be at least 4 M from the finished ground level or higher	Please provide contour map for proposed site	understanding of structure founding depth.	Bidder to refer Amendment-1.

7	PE-TS-412-158-A001	SECTION – IIA GENERAL TECHNICAL REQUIREMENT (MECHANICAL)	5.03.00	554	Detailed geotechnical investigation shall be carried out by the Contractor on award of work.	Detailed geotechnical investigation shall be in client's scope of work	Since construction of entire PT plant is not in bidder scope. Same will be excluded from bidder scope	Noted.
8	PE-TS-412-158-A001	SECTION – IIA GENERAL TECHNICAL REQUIREMENT (MECHANICAL)	5.13.00	557	SOIL IMPROVEMENT: Since soil is having very low bearing capacity hence Implementation of ground improvement techniques and post improvement evaluation of sub surface properties upto 15.0 m below ground level is a part of foundation design, which is in the scope of contractor.	Implementation of ground improvement techniques and post improvement evaluation of sub surface properties upto 15.0 m below ground level is in clients scope.	Since construction of all civil works will be in clients scope hence Implementation of ground improvement techniques and post improvement evaluation of sub surface properties upto 15.0 m below ground level will be in clients scope	Noted.

PRE-BID QUERIES

Sr. No.	Tender Clause	BHEL requirements	Query	BHEL reply
Specification No.: PE-TS-412-158-A001				
1	Scope: Page 12	This section refers to scope for the Pre-Treatment Plant (PT Plant)	Kindly confirm that the Bidder's scope are only the Items mentioned under 1.0 Scope (from Item 1.1 to 1.25)	Bidder to follow technical specification.
2	Data Sheet for Pretreatment Plant: Pages 163 to 168	These Data Sheets define the design criterias and mentions "Clarifloculator"	Kindly confirm that the Bidder's scope shall respect all the design criterias	Bidder to follow technical specification.
3	Data Sheet for Pretreatment Plant: Item 20.1 Sludge Transfer Pump - Page 167	Data sheet mentions Pump of 500 m3/hr	Kindly confirm the Pump flow as the sludge extraction will be <100 m3/hr	Bidder to follow technical specification.
4	Section - IIA: General Technical Requirement (Mechanical): Item 1.3 Clarifiers	This section refers to High Rate Solid Contact Clarifier with 3 m/hr average flow velocity	Kindly confirm whether the Bidder should consider Clarifloculator (1.2 m/hr) OR High Rate Solid Contact Clarifier (3 m/hr) average flow velocity	Bidder to note that type of clarifier shall be of clarifloculator type with rise rate of 1.2 CuM/Hr/SqM (maximum).
5	Section 4: Pages 194 to 199	This Section refers to Clarification followed by Gravity Dual media filters, Ultra Filtration modules & Cartridge Filters	Kindly clarify whether the Bidders needs to follow Data Sheets for Pretreatment Plant: Pages 163 to 168. If yes, kindly confirm Section 4 is not applicable for this Package	Bidder to refer Amendment-1
6	Section 13.14.00 Valve specifications	This Section defines the Material of Construction of Valves: Example: For Butterfly valves for sea water application, it is mentioned Body & disc in SS 316 L.	In the Data Sheet for Pretreatment Plant: Page168, it is mentioned that the Butterfly Valve body & disc should be CE3MN. Kindly confirm which section is applicable	Bidder to note that in case of any discrepancy, section IA shall prevail over section IIA
Price Format - For Indian Bidders: PE-TS-412-158-A001				
1	Price Format - for Indian Bidders	On Page 4 - Item n, it is mentioned Bidder to quote for 25% UF Membranes	Since the Pre-treatment Plant scope doesn't include UF, kindly provide us the revised Price Format. It is further requested to BHEL to provide Excel version of the Price format.	Biddert to note that UF Membranes are not applicable for Pre-Treatment Plant