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		I				Control Component India PVT Ltd	Sricity (Andhra Pradesh)	A			1.The critical components of control valve i.e. Disk Stack (Drag technology) shall be sourced from CCI, USA/CCI S. Korea . 2.The positioner from NTPC approved sources & pneumatic actuators are sourced from CCI S.Korea 3.Control valve to be manufactured as per CCI USA design & drawing.
		I				KOSO India Pvt Ltd	Nasik	A			
		I				KSB MIL Controls Ltd	Thrissur (Kerala)	A			Up to 10 Inches & 3400 ANSI class
		II				Dresser Produits industriels Industriels S.A.S	France	A			
		II				Nihon Koso Co Ltd	Japan	A			
		II				CCI	USA	A			
		II				Emerson (Fisher)	USA/France/Japan	A			
9-D	Control valve for feedwater flow Control										
		I				Control Component India PVT Ltd	Sricity (Andhra Pradesh)	A			1.The critical components of control valve i.e. Disk Stack (Drag technology) shall be sourced from CCI, USA/CCI S. Korea . 2.The positioner from NTPC approved sources & pneumatic actuators are sourced from CCI S.Korea 3.Control valve to be manufactured as per CCI USA design & drawing.
		I				KOSO India Pvt Ltd	Nasik	A			
		I				Emerson Process Management Ltd	Chennai	A			Control valve body assembly will be from Nippon Fisher ,Japan with IBR form III C certificates .
		I				KSB MIL Controls Ltd	Thrissur (Kerala)	A			1.Provision of straight type of brackets for linkage mechanism .2.Factory fitted strainer /diffuser type seat ring . 3.AFR with T connector for pneumatic connection to volume booster
		II				Dresser Produits industriels Industriels S.A.S	France	A			
		II				Nihon Koso Co Ltd	Japan	A			CONDITIONAL
		II				CCI	USA / Austria / S.Korea / Switzerland	A			
		II				Emerson (Fisher)	USA/France/Japan	A			
9-E	Control valves for Soot blower pressure reducing ,SH/ RH Attemperation.										

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		I				Control Component India PVT Ltd	Sricity (Andhra Pradesh)	A			1.The critical components of control valve i.e. Disk Stack (Drag technology) shall be sourced from CCI, USA/CCI S. Korea . 2.The positioner from NTPC approved sources & pneumatic actuators are sourced from CCI S.Korea 3.Control valve to be manufactured as per CCI USA design & drawing.
		I				KOSO India Pvt Ltd	Nasik	A			
		I				Emerson Process Management Ltd	Chennai	A			
		I				KSB MIL Controls Ltd	Thrissur (Kerala)	A			
		I				GE Oil & Gas India Pvt Limited	Coimbatore	A			up to 2500 ANSI Class
		I				Flow Serve India Controls Pvt Ltd	Bengaluru	A			
		I				Instrumentation Limited	Palakkad (Kerala)	A			only for SH / RH
		II				Nihon Koso Co Ltd	Japan	A			
		II				Dressor Masoneilan	USA	A			only for SH / RH/ up to 2500 class
		II				Dresser Produits industriels Industriels S.A.S	France	A			
		II				SPX Flow Technology	USA	A			only for SH / RH
		II				Leslie Controls Inc	USA	A			only for SH / RH
		II				Sempell AG (Tyco group)	Germany	A			only for SH / RH
		II				CCI	USA/Sweden /S.Korea	A			
		II				Emerson (Fisher)	USA/France /Japan	A			
9-F	Control valve(Other application)										
		I				Mascot Valves Pvt Ltd	Ahmedabad	A			Up to size 12 inches & 900 ANSI class
		I				Control Component India PVT Ltd	Sricity (Andhra Pradesh)	A			Up to 2500 ANSI class
		~~I~~				KOSO India Pvt Ltd	Nasik	~~A~~			
		I				KSB MIL Controls Ltd	Thrissur (Kerala)	A			Up to 2500 ANSI class
		I				Emerson Process Management Ltd	Chennai	A			Up to 2500 ANSI class
		I				GE Oil & Gas India Pvt Ltd	Coimbatore	A			Up to size 10 inches & 900 ANSI class /Up to size 24 inches & 600 ANSI class
		I				Flow Serve India Controls Pvt Ltd	Bengaluru	A			Up to size 14 inches & 600 ANSI class
		I				Forbes Marshal Arca Pvt. Ltd.	Pune	A			Up to size 16 inches & 900 ANSI class
		I				Instrumentation Limited	Palakkad (Kerala)	A			Up to 2500 ANSI class
		I				Severn Glocon India Pvt Ltd	Chennai	A			Up to size 14 inches & 300 ANSI class
		II				CCI	USA/Sweden /S.Korea	A			
		II				Nihon Koso Co Ltd	Japan	A			
		II				Emerson (Fisher)	USA/France /Japan	A			
		II				Leslie Controls Inc	USA	A			
		II				PARCOL S.P.A	Italy	A			

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		II				Dresser Produits industriels Industriels S.A.S	France	A			
		II				HORA	Germany	A			
		II				Wellend & Tuxhorn	Germany	A			
		II				SPX Flow Technology	USA	A			
		II				Sempell AG (Tyco group)	Germany	A			
9-G	Control Valve (Ceramic lined)										
		I				Samson Controls Pvt Ltd	Pune	A			1. For M/S Samson Cera Germany make valve Up to 10 inches size & 150 ANSI class 2. BOI shall be tied up at the time of finalisation of MQP
10	DDCMIS										
		I				ABB	Germany	A			
		I				SIEMENS AG	Germany	A			
		I				Emerson Process Management Asia Pacific Pvt Ltd	Singapore	A			
		I				Hitachi nest control system Pvt Ltd	Bengaluru	A			
		I				Honeywell Automation India Ltd	Pune	A			
		I				GE	France	A			
		I				SIEMENS	Gurugram	A			
		I				BHEL	Bengaluru	A			For MAX DNA System
		I				Yokogawa	Bengaluru	A			
		I				GE Power India Ltd	Noida	A			
		I				Toshiba	Japan	A			
		I				ABB	Bengaluru	A			
		I				Emerson Process Management Ltd	Pawane	A			
11	Dust Emision Monitor										
		III				Durag India Instrumentation Pvt Ltd	Bengaluru	A			1. For Durag Germany Make Extractive Type Dust density analyser 2. Other components shall be as per approval letter CQA/NTPC BARH STPP-I / D-263 / Durag India Instrumentation Pvt Ltd Bengaluru Dated 28.08.2019
		III				Sick India Pvt ltd	Mumbai	A			1.For SICK AG Make Extractive Type Dust density analyser 2. Other components shall be as per approval letter CQA/NTPC BARH-I /S-907/M/S SICK India Pvt Ltd dated 28.08.2019
		III				Environment SA India Pvt Ltd	Navi Mumbai	A			1.For ENEVA UK Make Extractive Type Dust density analyser 2. Other components shall be as per approval letter No.: CQA/NTPC BARH-I / E-335 / M/S Environment SA India Pvt Ltd Dated 16.09.2019
		III				Land Instruments International	UK	A			For In Situ type /Optical Transreceiver type

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		III				Codel	UK	A			For In Situ type /Optical Transreceiver type
		III				Durag Industrie Elektronik GmbH & Co KG	Germany	A			For In Situ type /Optical Transreceiver type & Extractive Type
		III				Emerson Process Management	Ireland	A			For In Situ type /Optical Transreceiver type
		III				SICK AG	Germany	A			For In Situ type /Optical Transreceiver type & Extractive Type
		III				ENEVA	UK	A			For Extractive Type Dust density analyser
12	Electrical Actuators										
12-A	Electrical Actuator (With gear box if applicable)										
		II				Antrieb Technik Pvt Ltd	Chennai	A			For low torque applications only
		II				Auma	Bengaluru	A			
		II				Limitorque	Faridabad	A			Model no L120,SMB,LY series, Gear Box T, HBC Series
		II				Rotork	Bengaluru	A			For low torque app (Up to 1000 Nm)
		II				Rotork Controls (India) Private Ltd	Chennai	A			For low torque app (Up to 1000 Nm) & High torque 4000 to 7000 Nm With integral starter for non critical applications
		III				Auma	Germany	A			
		III				Limitorque	USA	A			
		III				Rotork	UK	A			For low torque app (Up to 1000 Nm)
		III				Nippon gear	Japan	A			
		III				Drehmo GMBH	Germany	A			C Matic Series (DMC/DMCR)
12-B	Electrical Actuator- Non-Intrusive (With gear box if applicable)										
		I				Auma India Pvt Ltd	Bengaluru	A			Also acceptable for Field Bus based applicable
		I				Rotork Control	Chennai	A			Upto 630Nm
		III				Flowserve	USA	A			Also acceptable for Field Bus based applicable
		III				Bernard Controls	France	A			
12-C	Electrical actuator for ID/FD/PA Blade pitch ,IGV &SCOOP										
		III				Harold Beck & Sons Inc	USA	A			
		III				SIPOS Aktrorik GmbH	Germany	A			
13	Electronics Transmitter (Pressure , DP and DP based Flow/Level)										
13-A	Electronics Transmitter (Pressure , DP and DP based Flow/Level)										
		III				ABB Ltd	Bengaluru	A			2600T & critical item from ABB Italy/ Their approved source;
		III				Emerson Process Management Ltd	Pawane	A			
		III				Siemens Ltd	Thane	A			Model:-SITRANS P
		III				Honeywell Automation India Ltd	Pune	A			

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		III				Baldota Control and Equipment Pvt Ltd	Navi Mumbai	A			PT & DPT of LD 301 Series (SMAR)
		III				Yokogawa India Limited	Bengaluru	A			EJA-E 110,430,530 SERIES & all raw material and BOI under knocked down condotion (sensor assembly as a single unit) shall be sourced from M/S Yokogawa Japan
		III				M/s Endress + Hauser India Automation Instrument Pvt Ltd	Aurangabad	A			
		III				Emerson (Rosemount)	USA	A			
		III				Yokogawa	Japan	A			
		III				ABB	Germany / Italy	A			2600T & critical item from ABB Italy/ Their approved source;
		III				Siemens	France	A			Sitrans P DSIII Series
		III				Fuji Electric	France	A			FCX -AIII SERIES
		III				Fuji	Japan	A			
13-B	Electronics Transmitter -Field Bus Based (Pressure , DP and DP based Flow/Level)										
		I				ABB India Ltd	Bengaluru	A			One no of Transmitter will be sent at DDCMIS supplier for function testing of field bus communication with DDCMIS during FAT
		I				Yokogawa India Limited	Bengaluru	A			EJA-E 110,430,530 SERIES & all raw material and BOI under knocked down condotion (sensor assembly as a single unit) shall be sourced from M/S Yokogawa Japan
14	EQMS										
		I				SWAN	Hyderabad	A			1. Conductivity analyser, pH analyser and Temperature Transmitter will be of M/s ABB, UK make . 2. TSS analyser will be of M/s Daeyoon, South Korea make . 3. Oil in water analyser will be of M/s TriOs, Germany make. 4. Online BOD/COD analyser will be of M/s Shimadzu, Japan make . 5. Flow meter will be of M/s Khrone Marshall, Maharashtra make. 6. Data Aquisition System will be procured from Knowledge Lens, Karnataka.
15	Fiber optic cable										
		Note-3				U M Cables Ltd	Silvassa (Daman)	A			
		Note-3				KEC International Ltd	Mysore	A			
		Note-3				Apar Industries Limited	Valsad (Gujrat)	A			
		Note-3				HFCL	Goa	A			
		Note-3				Aksh Fibre	Bhiwadi (Raj)	A			

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		Note-3				Finolex Cable Ltd	Goa	A			
		Note-3				Birla Cable Limited	Rewa	A			
		Note-3				R&M	Switzerland	A			
		Note-3				Molex	UK	A			
		Note-3				Corning	USA	A			
16	Fire alarm Panel										
		II				Toshniwal Industrial Pvt Ltd	Ajmer	A			1.M/S Notifier Make Fire alarm Panel 2.Pl Refer Note-07
		II				Bosch Security system	Bengaluru	A			1.Detector , Hooter, MCP, Modules, Panel shall be M/s Bosch Make
		II				Notifier	USA	A			
		II				Autronica	Norway	A			
		II				Schrack	Austria	A			
		II				Edwards	Mexico	A			
		II				Shield Fire safety and security Ltd	UK	A			
		II				Jhonson Controls	Mexico	A			Simplex Brand
17	Flame Monitoring System (Scanner)										
		I				Lucent Marcons Pvt Ltd (System Integrator of M/S Forney Corporation USA)	Noida	A			1.Flame detector, amplifier ,light guide fiber optic , smart display programming unit , test kit & simulator will be supplied from M/S Forney Corporation USA 2.Other components like outer carrier ,IDD cable with connector , expander , Y connector with adapter gasket , fastners & signal isolators will be supplied from M/S Forney Corporation USA approved sources . 3.Pl Refer Note-7
		I				HI Tech System & services Ltd (System Integrator of BFI Germany)	Kolkata	A			1.For BFI Germany make system 2. Pl Refer Note-7
		II				Durag India Instrumentation Pvt Ltd	Bengaluru	A			For Durag Germany make system
		II				Forney Corporation	USA	A			
		II				BFI	Germany	A			
		II				Durag GmbH	Germany	A			
		II				Emerson (COEN)	USA	A			
		II				BHEL	Trichurapalli	A			
18	Flow nozzle assembly										
		I				Microprecision Product Pvt Ltd	Palwal	A			Up to Alloy steel material grade P-92 & other conditions as per approval letter
		I				Minco India Flow Elements Pvt. Ltd.	Goa	A			Up to size 26 Inches for Alloy steel/ Stainless steel pipe SA335 P-11, P -22 and SA 335 P-91 & other conditions as per approval letter
		I				Instrumentation Limited	Palakkad (Kerala)	A			Up to alloy steel grade P-92 subject to qualified WPS & other conditions as per approval letter

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		I				Starmech controls (India) Pvt Ltd	Pune	A			Up to alloy steel grade P-92 subject to qualified WPS & other conditions as per approval letter
		II				SEIKO	Czech Republic	A			
		II				WISE Control	S.Korea	A			
		II				Technomatic	Italy	A			
19	Flue Gas Analyser (CO)										
		III				Forbes Marshall Pvt Ltd	Pune	A			For In situ type CO analyser
		III				ICE (Asia) Pvt Ltd	Mumbai	A			For In situ type CO analyser 1. CO analyser from Protea UK 2. Other components like, Mounting Flanges, tubing, fittings ,junction boxes, air purging system , calibration cylinders & cables will be supplied by ICE (Asia) Pvt Ltd 3.Pl refer Note-7
		III				Sick India Pvt Ltd	Mumbai	A			For In Situ Type / CO analyser from SICK AG & Other components like ,Protection tube ,Flanges ,tubing ,fittings ,junction boxes, solenoid valves & calibration cylinders will be supplied by M/S Sick India Pvt Ltd .
		III				Emerson Process Management Ltd	Pawane	A			For M/S Emerson Germany/ USA make Analyser
		III				Codel	UK	A			
		III				Land Instruments International	UK	A			
		III				Sick AG	Germany	A			For In Situ Type
		III				Envoirenment SA	France	A			For Hot Extractive
		III				Fuji Electric	Japan	A			
		III				Servo max Group	UK	A			
		III				Siemens	Germany	A			
20	Flue Gas Analyser (CO2,SO2 and Nox)										
		III				Sick India Pvt Ltd	Mumbai	A			For In Situ Type SO2 analyser 1. Analyser will be from Sick AG Germany 2. Other components like ,Whether proof covers ,flanges ,purge air unit ,junction boxes ,cables ,PC ,remote display ,gas cylinders shall be supplied by M/s Sick India Pvt Ltd
		III				Emerson Process Management Ltd	Pawane	A			For M/s Emerson Germany/ USA make Hot Extractive SO2, NOx Analyser
		III				Envoirenment SA	France	A			For Hot Extractive
		III				Fuji Electric	Japan	A			Hot Extractive Type For SO2 & Nox
		III				Siemens	Germany	A			Hot Extractive Type For SO2 & Nox
		III				Yokogawa Electric Corporation	Japan	A			IR-400 Series (Hot Extractive Type For CO2, SO2 & NOx)
		III				Servo max Group	UK	A			Hot Extractive Type For SO2 & Nox
		III				Sick AG	Germany	A			Hot Extractive Type For CO2, SO2 & NOx and In situ type for SO2 analyser
21	Flue Gas Analyser O2 Analyser (HT)										

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		III				SECO	Chennai	A			
		III				Marathon Monitor	USA	A			
		III				Servo max Group	UK	A			
22	Flue Gas Analyser {O2 Analyser (LT)}										
		III				Sick India Pvt Ltd	Mumbai	A			For In Situ Type 1. Analyser will be from Sick AG Germany 2. Other components like ,Whether proof covers ,flanges ,purge air unit ,junction boxes ,cables ,PC ,remote display ,gas cylinders shall be supplied by M/s Sick India Pvt Ltd
		III				Analyser Instruments Co Pvt Ltd	Kota	A			For In Situ Type 1.Main parts like Sample probe & Analyser will be supplied by M/s Enotec Germany. 2. Other components like auto calibration unit ,probe protector ,enclosure panel & calibration kit will be supplied & integrated M/s AIC kota. 3.Pl refer Note-07
		III				Emerson Process Management Ltd	Pawane	A			For In Situ Type For M/s Emerson USA make Analyser
		III				ABB	Bengaluru	A			For In Situ Type For M/s ABB UK make Analyser
		III				Yokogawa India	Bengaluru	A			For In Situ Type For M/s Yokogawa Japan make Analyser
		III				Enotech GmbH	Germany	A			For In Situ Type
		III				Ametek	USA	A			For In Situ Type
		III				Yokogawa Electric Corporation	Japan	A			For In Situ Type
		III				Servo max Group	UK	A			For In Situ Type
		III				Sick AG	Germany	A			For In Situ Type
23	Continous Emisson Monitoring system										
		I				Horiba India Pvt ltd	Pune	A			Approval conditions as per approval letter no - CQA/NTPC Mauda-II / H-321 / M/S Horiba India Pvt Ltd Dated 03.10.2019
		I				Yokogawa India Ltd	Bengaluru	A			1. SO2,NOx & CO2 Analyser will be from M/S Yokogawa Electric Corporation Japan . 2.Other Conditional as per approval letter no Ref. No.:-CQA/BARH-I / Y-023/ M/s Yokogawa India Ltd dated 21.05.2020
		I				Adage Automation Pvt Ltd.	Goa	A			For M/s Siemens Germany make SO2,NOx & CO2 Analysers

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		I				Thermo Fisher Scientific India Pvt. Ltd	Pune	A			Approved only for Dilution Extractive Technique 1)Analyser (SO2,NOx,CO,CO2,Mercury), sampling probe ,sample handling system ,umbical cord etc to be supplied from M/S Thermo Fisher USA . 2) Other BOI shall be as per LOA approved sources
		I				Emerson Process Management India Pvt Ltd	Pawane	A			For M/s Emerson Germany make SO2,NOx & CO2 Analysers other conditions as per approval letter.
		I				Analyser Instruments Co Pvt Ltd	Kota	A			Analysers from Fuji Japan & other BOI shall be as per LOA approved sources .
		I				Envoirenment SA India Pvt Ltd	Navi Mumbai	A			Hot Extractive Type / 1.Multipoint gas Analyzers MIR-9000 for SO2, NOx,CO2 & CO ,Probe ,Nafyon drier & heater for drier will be of M/S Environment SA France make. 2. Other components shall be as per the approval letter ref no CQA/NTPC Telangana/E-335/M/SEnvoirenment SA India dated 12.02.2019
24	Furnace Flame viewing system (High Temperature CCTV Components)										
		III				Sertel Electronics Pvt. Ltd.	Chennai	A			Approved for Visible type only
		III				Hi Tech System and Service (System Integrator of M/S Lenox USA)	Kolkata	A			1.M/S Lenox USA Make System 2.Pl refer Note-07
		III				Durag India Instrumentation Pvt Ltd	Bengaluru	A			1.Complete Camera Assembly, IRIS Control etc. from Durag Germany 2.Other Component like chiller, vedio monitor, OFC ,Panel from M/S Durag Approved sources
		III				TLT Engg Pvt. Ltd. (System Integrator of M/S Diamond Power USA/ Sweden make system)	Kolkata	A			1.M/S Diamond Power USA/ Sweden make system 2.Pl refre Note-07
		III				Toshniwal Industries (System Integrator of M/S Mirion UK make system)	Ajmer	A			1. M/S Mirion UK make system 2.Pl refer Note-07
		III				Diamond Power	USA / Sweden	A			
		III				Durag GmbH	Germany	A			D-VTA-201
		III				Lenox	USA	A			
		III				Mirion	UK	A			
		III				Piper GmbH	Germany	A			
		III				Sabota GmbH	Germany	A			
25	H2 Gas Analyser										
		I				ABB India Ltd	Bengaluru	A			M/s ABB Germany /UK Make analyser

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		I				Adage Automation Pvt. ltd	Goa	A			1.M/s Siemens, Garmany (Calomat 6) Make analyser 2. Pl refer Note-07
		I				Yokogawa India ltd	Bengaluru	A			M/s Yokogawa Japan (Gas Densitybased) Make analyser
		I				SIEMENS	Gurugram	A			M/s Siemens, Garmany (Calomat 6) Make analyser
		III				GE Sensing EMEA	Ireland	A			Conductivity based
		III				ABB	UK	A			
		III				Emerson (Rosemount)	USA	A			
		III				Environment One Corporation	USA	A			Conductivity based
26	HEA ignitor										
		I				Durag India Instrumentation Pvt Ltd	Bengaluru	A			M/S Durag Germany make HEA Ignitor
		I				Hindustan Thermometers	Ambala	A			Condtional as per approval ref no 01/CQA/0270-102 dated 17.09.2012.Spark tip of their own make is also acceptable
		I				Fives combustion System Pvt Ltd	Vadodara	A			
		I				Boiler control Pvt Ltd	Puddukottai (Tamilnadu)	A			Approved for Aux Boiler package only
		III				Unison Industries	USA	A			
		III				Durag GmbH	Germany	A			
		III				Ignition system INC	USA	A			
		III				Tesi SPA	Italy	A			
27	High Temp. cable (PTFE/FEP)										
		II				Thermocables	Hyderabad	A			
		II				Tempsens	Udaipur	A			
		II				Habia cables	Sweden	A			
		II				Thermo Electrica BV	Netherland	A			
		II				Lapp cables	Germany	A			
		II				Kerpen cables	Germany	A			
		II				TEW & C	USA	A			
28	Impulse Pipes/Tubes										
		II				Mahrashtra Seamless	Raigarh	A			For CS Pipes only
		II				Ratnamani Metals and Tubes	Gandhinagar	A			For SS only.
		II				Heavy Metals and Tubes	Gandhinagar	A			For SS & CS only.
		II				ISMT	Ahamadnagar	A			For CS/ AS upto Gr 22 Pipes only
		II				Nippon Steel & Sumitomo Metals corporation	Japan	A			
		II				TPS Tecnitube	Germany	A			
		II				Veluric & Manessmann	Germany	A			
		II				Trouvay and Cauvin	France	A			
		II				Sandvik	Sweden	A			For SS only
		II				REMI Edelstahl Tubulars Ltd	Palghar	A			
29	Instrument Cables (F,G & T/C Cables)										
		Note-2				Goyolene Fibers (India) Pvt Ltd	Silvassa	A			F&G Type Cable
		Note-2				Temsens Instruments Ind Pvt Ltd	Udaipur	A			
		Note-2				Havells India	Alwar	A			F Type Cable

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		Note-2				Paramount Communication Ltd	Khuskhera	A			
		Note-2				Polycab	Daman	A			
		Note-2				Delton	Faridabad	A			
		Note-2				KEI	Bhiwadi (Raj)	A			
		Note-2				Elkey Telelinks	Faridabad	A			
		Note-2				CORDS	Kaharani	A			
		Note-2				CORDS	Bhiwadi	A			
		Note-2				Nicco	Kolkata	A			
		Note-2				Universal Cable	Satna	A			
		Note-2				Thermocables	Hyderabad /Mahboobnagar	A			
		Note-2				Gupta Power Inftrastructure Ltd.	Khurdha	A			
		Note-2				CMI	Faridabad	A			
		Note-2				Advance Cables Pvt Ltd	Bengaluru	A			F&G Type Cable
		Note-2				Gemscab Industries Ltd	Bhiwadi (Raj)	A			F&G Type Cable
		Note-2				Apar Industries Limited	Valsad	A			F&G Type Cable
		Note-2				Suyog Electricals Ltd	Halol (Gujrat)	A			
		Note-2				Special Cables Pvt Ltd	Rudrapur	A			
		Note-2				T C Communication	Ghaziabad	A			
		Note-2				TEW & C	USA	A			
		Note-2				Habia cables	Sweden	A			
		Note-2				Kerpen cables	Germany	A			
		Note-2				Lapp cables	Germany	A			
		Note-2				Thermo elecrta Bv	Netherland	A			
30	Intelligent Battery charger 24V DC / DCDB/BHMS										
		II				Chabbi Electricals	Jalgaon	A			Rectifier module, Controller module and Battery Health monitoring system shall be of M/s Vertiv make
		II				Eltek SGS Pvt Ltd	Gurugram	A			
		II				Vertiv Energy Pvt ltd	Pune	A			
31	Large Video Screen (LED Based)										
		I				Pyrotech Electronics Pvt Ltd	Udaipur	A			
		I				Delta India Electronics Pvt Ltd	Gurugram	A			
		I				Barco Electronics system (P) Ltd	Noida	A			
		I				Planner System Inc	USA	A			
32	Level switch- Conductivity type										
		II				Raman Instruments (System integrator of Delta Morbey/ Emerson Mobrey /Solartron -Mobrey)	Delhi	A			1.M/S Emerson (Morbey) UK system 2.Pl refer Note-07
		II				HI Tech System & services Ltd (System Integrator of Levelstate systems Ltd ,UK)	Kolkata	A			1. M/S Levekstate UK System .Vessel from M/s Hi Tech 2.Pl refer Note-07
		II				BHEL	Trichurapalli	A			
		III				Emerson -Mobrey (Solartron mobrey)	UK	A			
		III				Levelstate Systems Ltd	UK	A			
		III				Yarway	USA	A			

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33	Local Instrument Enclosure/Rack										
		I				Pyrotech Electronics Pvt. Ltd	Udaipur	A			BOI from LOA approved sources
		I				Sajas electrical	Trichurapalli (Tamilnadu)	A			BOI from LOA approved sources
		I				Prammen	Puddukottai (Tamilnadu)	A			BOI from LOA approved sources
		I				Chemin C&I Pvt Limited	Puducherry	A			1- BOI from LOA approved sources 2.Fabrication at M/s LUFT tech India 3- Painting at M/s Supreame Coater & Fabricator
34	Master Slave Clock System										
		I				Signals and Systems Pvt. Ltd. (SANDS)	Chennai	A			
		I				Masibus	Gandhinagar	A			
		I				Sertel Electronics Pvt. Ltd.	Chennai	A			
		II				Hopf Electronik GmbH	Germany	A			
		II				Hathway	USA	A			
		II				Mein Berg	Germany	A			
		II				Moser Baer AG	Switzerland	A			
35	Mercury Analyser										
		I				Analyser Instrument Co. Pvt Ltd (AIC)	Kota	A			1. Mercury Analyzer from PS Analytical UK 2.System integration & supply of components like, Enclosure with AC, calibration cylinders, PC will be done by M/s Analyser Instrument Co. Pvt Ltd (AIC) Kota . 3.Pl refer Note-07
		III				Environment SA India Pvt Ltd	Navi Mumbai	A			1-Mercury analyzer with accessories will be from Mercury instruments GmbH Germany . 2- Other components like, sample line between probe to mercury analyzer will be supplied by M/s Environment SA India Pvt Ltd .
		III				Thermo Fisher Scientific India Pvt Ltd	Pune	A			1. Mercury Analyser shall be from Thermofisher USA 2. Other approval conditions are as per approved letter ref no 01/CQA/9578-001/Thermofisher dated 09/12/2016
		III				Durag India Instrumentation Pvt Ltd	Bengaluru	A			Analyser from M/s Verewa Umwelt Germany
		III				Mercury Instruments GmbH	Germany	A			
		III				SICK AG	Germany	A			
		III				Themofisher	USA	A			
		III				Lumax	Russia	A			For AAQMS System
36	PA System (IP Based)										
		III				BNA Technology Consulting Ltd.	Bengaluru	A			BOI shall be from LOA approved sources.
		III				Armtel	Russia	A			

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		III				Zenitel	Norway	A			1.PA system active component , Proprietary item will be Zenitel Norway make 2.Other components & BOI shall be from LOA approved sources
		III				Commend International GMBH	Austria	A			
36A	PA System (IP Based)/System Integrators										note-7
		III				Willstrong Solutions Pvt. Ltd	Greater Noida	A			For M/s Armtel Russia system Approval conditions as per approval letter no Patratu-QA/9585-001-102/VA-Willstrong Dated: 21.12.20
		III				Toshniwal Industries Pvt ltd	Ajmer	A			For M/s Commend Austria make system
		III				Aishan Technologies Pvt Ltd	Bengaluru	A			For M/s Zenitel Norway make system
		III				Haritasa Checkmate Electronics Pvt Ltd	Bengaluru	A			For M/s Commend Austria make system
		III				Netware Computer Pvt Ltd	New Delhi	A			For M/s Commend Austria make system
37	PLC System										
		I				Emerson Automation solution Intellegent plateforms Pvt Ltd	Bengaluru	A			PLC modules from M/s Emerson USA & BOI shall be from LOA approved sources
		I				ABB India Ltd	Bengaluru	A			
		I				Schneider Electric system india Pvt Ltd	Chennai	A			PLC modules from M/s Schneider France & BOI shall be from LOA approved sources
		I				Rockwell	Sahibabad	A			
		I				Siemens	Nasik	A			
		I				Honeywell	Pune	A			PLC modules from M/s Honeywell ,S.Korea & BOI shall be from LOA approved sources
		I				Schneider Electric India Pvt Ltd	Bengaluru	A			PLC modules from M/s Schneider France & BOI shall be from LOA approved sources
37-A	PLC System Integrators										**Note-11 and note-7**
		I				Ladder Automation Solution Pvt Ltd	Gurugram	A			For M/s Honeywell make system
		I				Virtual Automation	Ranga Reddy (Telangana)	A			For M/s Schneider make system
		I				Cotmac Electronics Pvt Ltd	Pune	A			For M/s SIEMENS make system
		I				Tech-Masters	Hyderabad	A			For M/s Emerson make system
		I				Powertech Switchgear (I) Pvt Ltd	Sonepat	A			For M/s Schneider make system
		I				Unity Industrial Automation Pvt Ltd	Delhi	A			For M/s Rockwell make system
		I				EMCONS	Ranchi	A			For M/s Rockwell make system
		I				Divya Engineers	Chennai	A			For M/s SIEMENS make system
		I				M D Industries	Vadodara	A			For M/s Emerson make system
		I				Velox automation	Surat	A			For M/s SIEMENS make system

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		I				Vision Comptel	Kolkata	A			For M/s Emerson make system
		I				Adaptive Engineering Private Limited	Ahmedabad	A			For M/s Schneider make system
		I				Greenwave Solutions Private Limited	Kolkata	A			For M/s Rockwell make system
		I				Dreamz Automation	Ghaziabad	A			For M/s SIEMENS make system
		I				Creative Robotics	Ghaziabad	A			For M/s Honeywell make system
		I				Kruti Techno Engineer Pvt Ltd	Chhapraula (GB Nagar	A			For M/s SIEMENS make system
		I				EDS Instruments & Systems Pvt Ltd	Chennai	A			For M/s Honeywell make system
		I				Delsys Automation Technologies Pvt Ltd	Chennai	A			For M/s Emerson make system
		I				Hindustan Controols and Equipment Ltd	Kolkata	A			For M/s Emerson make system
		I				Vollkraft Engineering And Consultant (P) Ltd	Kolkata	A			For M/s Emerson make system
		I				SSM Infotech Solutions Pvt Ltd	Surat	A			For M/s Schneider make system
		I				Sun Industrial Automation & Solutions	CHENNAI	A			For M/s Schneider make system
		I				ARTEE FLOW CONTROL PVT LTD	ANKLESHWAR	A			For M/s Honeywell make system
		I				CSS AUTOMATION PVT. LTD	KOLKATA	A			For M/s Emerson make system
		I				ARMAX AUTOMATION PVT LTD	BANGALORE	A			For M/s ABB make system
		I				KAIZEN AUTOMATION	AHEMDABAD	A			For M/s Schneider make system
		I				ELECON PERIPHERALS LIMITED	ANAND	A			For M/s ABB make system
38	Pneumatic Actuator Regulating (Power Cylinder HAD,CAD SADC & Burner Tilt)										
		I				Instrumentation Limited	Palakkad (Kerala)	A			
		I				Kelton	Cochin (Alleppy)	A			
		I				SMC Corporation India Private Ltd	Noida	A			Up to Bore size 12 inches
		I				IMI Norgren Herion Pvt ltd	Noida	A			
		I				NELES INDIA PRIVATE LIMITED	Dombivli	A			
		II				Dong Woo Valve Control Co. Ltd	S.Korea	A			
		II				Shin Hwa Engineering Co. Ltd	S.Korea	A			
39	Radar type level transmitter										
		III				Limaco	Russia	A			High Frequency Type
		III				Emerson Process Management Ltd	Pawane	A			For M/s Emerson Singapore make
		III				Endress & Houser	Aurangabad	A			
		III				SIEMENS	Canada	A			
		III				B M Technology	Italy	A			For Non Contact type
		III				Magnetrol	Belgium	A			

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		III				ABB	USA	A			K-Tech Brand
		III				Endress & Houser	Germany	A			
		III				Saab Rosemeount	Sweden	A			
		III				Emerson Process Management	Singapore	A			Rosemount 3300 series for GW Radar & 5600 Series for Non-Contact type
		III				Endress & Houser	Germany	A			
		III				Vega Grieshaber KG	Germany	A			
40	Short Term Fire Proof cable										
		III				nVent Solutions limited	UK	A			
		III				Wrexham Mineral	UK	A			
		III				KME	Italy	A			
41	SWAS (Sampling Handling System and Dry Panel)										
		I				Emerson Process Management Ltd	Navi Mumbai	A			Analysers and Other BOI Componets from LOA agreed source
		I				Forbes Marshall	Pune	A			Analysers and Other BOI Componets from LOA agreed source
		I				SEPL	Pune	A			Analysers and Other BOI Componets from LOA agreed source
		I				YOKOGAWA INDIA LTD	Bangalore	A			Analysers and Other BOI Componets from LOA agreed source
42	Water Analyser (Chloride, Conductivity, Dissolved Oxygen,pH, Hydrazine, Concentration , Phosphate, Silica, Soldium,Turbidity, Total Iron, Degassed Cation Conductivity)										
		III				Emerson Process Management Pvt Ltd	Pawane	A			For Conductivity,pH, Dissloved Oxygen, Turbidity
		III				Mettlet Toledo India Pvt Ltd	Vasai	A			For pH Analyser (1. PH analyser from M/S Mettler Toledo GmbH Switzerland 2. Other components like, Housing, Panel mounting kit, Tubing's & easy clean mechanism will be supplied by M/s Mettler Toledo India Pvt Ltd)
		III				Endress Hauser India Pvt. Limited	Mumbai	A			For pH Analyser (1. pH sensor with cable , analyser ,retract & cleaning assembly , electrolyte reservoir (As applicable) will be supplied from Principals of M/S Endress Hauser India Pvt. Limited. 2. Other components like, Flow through assembly shall be supplied from M/S Endress Hauser India Pvt. Limited approved sources.)
		III				Thermo Fisher Scientific	USA	A			For Chloride,Dissloved Oxygen,Hydrazine
		III				ABB	UK	A			For Chloride,Dissloved Oxygen,Hydrazine, Phosphate, Silica,Sodium,Turbidity
		III				Hach	USA	A			For Conductivity, pH,Concentration, Phosphate, Silica,Turbidity

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		III				ABB	USA	A			For Conductivity, pH
		III				Yokogawa	Japan	A			For Conductivity
		III				Hach	Switzerland	A			For Dissloved oxygen, Hydrazine, Silica,Sodium
		III				Yokogawa	Japan	A			For pH
		III				Eutech Instrument PTE Ltd	Singapore	A			For Silica
		III				Orion	USA	A			For Sodium
		III				SWAN Analytische Instrumente AG	Hinwil /Switzerland	A			For pH Analyzer , Conductivity analyser ,Dissolve Oxygen analyser , silica Analyzer , Sodium Analyzer , Hydrazine analyser , Turbidity analyser
		I				Forbes Marshall Pvt Ltd	Pune	A			For Conductivity & pH analyser
		I				METTLER TOLEDO INDIA PVT LTD	Mumbai	A			For Chloride Analyser
43	Temp Transmitter										
43-A	Temp Transmitter										
		III				Endress & Houser	Aurangabad	A			
		III				Emerson Process Management Ltd	Pawane	A			For M/s Emerson Singapore make
		III				Yokogawa	Bengaluru	A			Make Yokogawa japan and caliberation at Yokogawa Banglore
		III				ABB	Bengaluru	A			For M/s ABB Germany make
		III				WIKA Instruments India Pvt Ltd	Pune	A			For M/s WIKA Germany make Model no T-32
		III				Honeywell Automation India Ltd	Pune	A			
		III				Yokogawa	Japan	A			
		III				Moore	USA	A			
		III				M System co Ltd	Japan	A			Model No-B3HU-0
		III				Emerson	U.S.A/Singapore/ Germany	A			
		III				ABB	Germany	A			
		III				Emerson Process Management	Germany	A			
43-B	Temp Transmitter -Field Bus based Single/Dual Input										
		I				ABB India Ltd	Bengaluru	A			One no of TT will be available at DCS supplier for function testing of field bus communication with DCS during FAT
44	Turbine supervisiory Instruments along with vibration analysis system.										
		I				GE	Pune	A			For GE Bentlly ,USA make system
		I				Meggitt India Pvt ltd	Bengaluru	A			For Meggitt (Vibrometer) Switzerland make system
		I				Forbes Marshall	Pune	A			For Shinkawa ,Japan make system
		II				GE BENTLY	USA	A			
		II				SHINKAWA	JAPAN	A			
		II				MEGGITT	Switzerland	A			
45	Ultrasonic Type Flow Meter (for Stack)										
		III				Sick India Pvt ltd	Mumbai	A			For Sick AG Germany make
		III				Sick AG	Germany	A			

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		III				Durag	Germany	A			
		III				Teledyne	USA	A			
46	Ultrasonic type level Transmitter										
		III				EIP Enviro	Noida	A			1-Ultrasonic level Tx shall be BM Technology Italy make 2-Required mounting arrangement , Testing, Calibration shall be carried out at M/s EIP Works.
		III				E & H	Aurangabad	A			
		III				Emerson Process Management Ltd	Pawane	A			Complete Intrument Transmitter & Probe to be procured from Mobrey UK , only intergration & configuration at Pawane works
		III				BM Technology	Italy	A			
		III				Siemens Miltronics	Canada	A			
		III				Nivelco Process Control	Hungary	A			
		III				E & H	Germany	A			
		III				HAWK Measurement PTY Ltd	Australia	A			
47	UPS With ACDB										
		Note-5				Vertive Energy Pvt Ltd	Pune	A			Upto 125 KVA for 1 phase and 300 KVA for 3 Phase
		Note-5				Vertive Energy Pvt Ltd	Mumbai	A			Upto 160 KVA
		Note-5				Hitachi Hirel Power Electronics Pvt Ltd	Gandhinagar	A			Upto 200 KVA,
		Note-5				Fuji Electric Consul Neowatt Private Limited	Pune	A			Up to 100 KVA single phase
		Note-5				KELTRON	Trivendrum	A			
		Note-5				Merlin & Gerin	France	A			
		Note-5				Gutor	Switzerland	A			
		Note-5				AEG	Germany	A			
		Note-5				Fuji Electric	Japan	A			
48	Vibration Monitoring System										
		II				Sensonics Technology India	Kundli	A			For Sensonic UK system
		II				BHEL	Bengaluru	A			1. Imported items like Vibration Monitors, Cross Connection Cables, Buffered Output Modules, and Piezoelectric Vibration Sensors, Eddy Current type Proximity Probe, Extension Cable and Signal Conditioner will be procured from Valmet Automation, Finland. 2.Indigenous items like Communication cables, networking components, blank panels, TB, OWS will be procured from NTPC approved sources.
		II				IRD Mechanlysis Ltd	Thane	A			Vibration sensors will be sourced from M/s Hansford UK ,however brand name of IRD and its logo is acceptable with suitable tracebility of M/s Hansford ,UK.

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		II				Forbes Marshall Pvt Limited	Pune	A			VMS hardware , Sensors ,extention cables shall be shinkawa Japan make .2. All other BOI shall be from LOA agreed sources
		II				GE	Pune	A			For GE Bentley , USA Make
		II				Rockwell Automation	Sahibabad	A			For Rockwell USA make
		II				SKF	Pune	A			For SKF USA make
		II				Imageneous Engineering Pvt Ltd	Vadodara	A			1-For Meggitt Switzerland make 2- Refer note 7
		II				Shinkawa	Japan	A			
		II				GE	USA	A			Bentley Niveda brand
		II				Meggitt	Switzerland	A			
		II				Sensonic Limited	UK	A			
49	Wireless Solution (Microwave Tower Communication)										
		I				L&T Technology Services (LTTS)	Bengaluru	A			1- Wireless Product (Access Point, Antenna) shall be M/s Cambium UK Make 2- Other Item like Switch, Cat-6 Cable can be supplied from M/s LTTS approved sources meeting technical requirements.
		I				Lotus wireless technologies India Pvt Ltd	Visakhapatnam	A			
		I				Sheetal Wireless Technologies Pvt Ltd	Pune	A			
		III				Proxim Wireless Corporation	USA	A			BOI shall be as per approval letter
50	Field Bus Cable/ Profibus Cable- PA & DP type										
		I				LAPP India Pvt Ltd	Bangalore	A			
		I				Thermo Cables Ltd.	Mahboobnagar	A			
51	Field bus components (Field bus modules ,segment protector ,surge protector & SS JB)										
		III				Phoenix Contact Inc	USA	A			Materiall will be allowed to dispatch from the vendor works as CAT-III item ,however all material except SS junction box will be available at DDCMIS supplier works for functional testing .
		III				Pepperl + Fuchs Pte Ltd	Singapore	A			Materiall will be allowed to dispatch from the vendor works as CAT-III item ,however all material will be available at DDCMIS supplier works for functional testing .
52	Stockyard Management System(Including 3D profiling scanner ,Thermal Imaging Camera, RTK GPS)										
		III				TSA	Brazil	A			For 3D profiling / Tripple-IN Germany make

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		I				EIP Enviro	Noida	A			For 3D profiling / 1-Tripple-IN Germany make Laser Scanner and RPU along with software from TSA Brazil inline with the M/s TSA Letter. 2- Other item like ethernet cable, Ethernet Switch, Junction Box required for execution of 3D stockpile managemment system can be supplied by EIP Enviro
53	Perimeter Intrusion Detection System										
		III				Senstar	Canada	A			
54	Radar based Perimeter Surveillance System										
		III				Magos System Ltd	Israel	A			Third Party "Cyber Penetration report " shall be provided along with material TC/COC
55	Thermal Camera (PTZ)										
		III				FLIR Commercial Systems INC	USA	A			
Main Contractor approved sources (Note-12)											
MC-1	Amonia Analyser	III				Main Contractor Approved Sources					
MC-2	Amonia leak detector	III				Main Contractor Approved Sources					
MC-3	Air Filter Regulator	III				Main Contractor Approved Sources					
MC-4	Anemometer	III				Main Contractor Approved Sources					
MC-5	Annunciator	III				Main Contractor Approved Sources					
MC-6	Battery Health Monitoring System	III				Main Contractor Approved Sources					
MC-7	Biofouling/ Deposit Monitor	III				Main Contractor Approved Sources					
MC-8	Coal bunker Level monitor	III				Main Contractor Approved Sources					
MC-9	Compression Fittings(SS)	III				Main Contractor Approved Sources					
MC-10	Condensing Pots	III				Main Contractor Approved Sources					
MC-11	Conduits /Pipe (GI)	III				Main Contractor Approved Sources					
MC-12	Conduits lead coated (Flexible)	III				Main Contractor Approved Sources					
MC-13	Copper tubing/Brass connectors	III				Main Contractor Approved Sources					
MC-14	Coriolios Type Mass Flow meter	III				Main Contractor Approved Sources					
MC-15	Coupling /Interposing Relays	III				Main Contractor Approved Sources					
MC-16	Density Indicator	III				Main Contractor Approved Sources					
MC-17	Desk for OWS/EWS/Printer/Server	III				Main Contractor Approved Sources					
MC-18	Digital Indicators	III				Main Contractor Approved Sources					
MC-19	Dust Sensor	III				Main Contractor Approved Sources					
MC-20	Dew point sensor/meter (H2)	III				Main Contractor Approved Sources					
MC-21	Flow Gauge	III				Main Contractor Approved Sources					
MC-22	Flow Indicator cum Totaliser	III				Main Contractor Approved Sources					
MC-23	Flow Switch	III				Main Contractor Approved Sources					
MC-24	FRP Junction Box	III				Main Contractor Approved Sources					
MC-25	Furniture for control Room(Chair, Almira, Lock)	III				Main Contractor Approved Sources					
MC-26	Furnace exit gas temp probe	III				Main Contractor Approved Sources					
MC-27	Graphic Interface Unit	III				Main Contractor Approved Sources					
MC-28	Hand Held Calibrator	III				Main Contractor Approved Sources					
MC-29	Hart Management System	III				Main Contractor Approved Sources					

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MC-30	Humidistat / Thermostat / Gyserstat / Airstat	III				Main Contractor Approved Sources					
MC-31	Instant Corrosion Rate Monitor & Portable Corrosion Meter	III				Main Contractor Approved Sources					
MC-32	Impact head type flow element	III				Main Contractor Approved Sources					
MC-33	Instrument Tube Fittings (Air)	III				Main Contractor Approved Sources					
MC-34	Instrument Valve	III				Main Contractor Approved Sources					
MC-35	IR Detector	III				Main Contractor Approved Sources					
MC-36	KVM Switch/Matrix KVM Switch	III				Main Contractor Approved Sources					
MC-37	Level gauge (Transperent & Reflex, Tubular type)	III				Main Contractor Approved Sources					
MC-38	Level Indicator (Float & Board type)	III				Main Contractor Approved Sources					
MC-39	Level switch - Float/Displacer Type	III				Main Contractor Approved Sources					
MC-40	Level Switch (RF Type)	III				Main Contractor Approved Sources					
MC-41	Level switch capacitance type	III				Main Contractor Approved Sources					
MC-42	Limit Switch	III				Main Contractor Approved Sources					
MC-43	Maintenance and Calibration Equpiment	III				Main Contractor Approved Sources					
MC-44	Mini UPS-Type C configuration	III				Main Contractor Approved Sources					
MC-45	Orifice plate assembly	III				Main Contractor Approved Sources					
MC-46	On line carbon in Ash analyser	III				Main Contractor Approved Sources					
MC-47	Pitot Tube	III				Main Contractor Approved Sources					
MC-48	Pr./Vaccum./DP Gauges	III				Main Contractor Approved Sources					
MC-49	Press, DP, Vaccum Switch	III				Main Contractor Approved Sources					
MC-50	Printer (Dot Matrix/Inkjet / Laser)	III				Main Contractor Approved Sources					
MC-51	Psycrometer	III				Main Contractor Approved Sources					
MC-52	Pulse jet Controller	III				Main Contractor Approved Sources					
MC-53	Pulse Valve	III				Main Contractor Approved Sources					
MC-54	Residual Chlorine Analyser	III				Main Contractor Approved Sources					
MC-55	Rotameter	III				Main Contractor Approved Sources					
MC-56	Reverse Rotation Indicator	III				Main Contractor Approved Sources					
MC-57	Synchronising Relay	III				Main Contractor Approved Sources					
MC-58	Synchroscope	III				Main Contractor Approved Sources					
MC-59	Semaphore Indicators	III				Main Contractor Approved Sources					
MC-60	Sight Flow Indicator	III				Main Contractor Approved Sources					
MC-61	Smart Positioner	III				Main Contractor Approved Sources					
MC-62	Socket Weld Fittings	III				Main Contractor Approved Sources					
MC-63	Solenoid Valve	III				Main Contractor Approved Sources					
MC-64	Solid Mass Flow Meter	III				Main Contractor Approved Sources					
MC-65	Terminal Block (Cage and Clamp type)	III				Main Contractor Approved Sources					
MC-66	Temperature cum Humidity Indicator	III				Main Contractor Approved Sources					
MC-67	Temperature Element(Thermocouple , RTD & Thermowell)	III				Main Contractor Approved Sources					
MC-68	Temperature Gauge(With Thermowell)	III				Main Contractor Approved Sources					
MC-69	Temperature Switch	III				Main Contractor Approved Sources					
MC-70	Transducer	III				Main Contractor Approved Sources					
MC-71	Tube thicknes Meter	III				Main Contractor Approved Sources					
MC-72	Voltmeter/ Watterhour Meter	III				Main Contractor Approved Sources					
MC-73	Valve manifolds	III				Main Contractor Approved Sources					
MC-74	Electric to Pneumatic Converter	III				Main Contractor Approved Sources					
MC-75	Network components	III				Main Contractor Approved Sources					
MC-76	Isolator	III				Main Contractor Approved Sources					
MC-77	ORP Monitor /Analyser	III				Main Contractor Approved Sources					
MC-78	Ultrasonic Type Flow Transmitter	III				Main Contractor Approved Sources					

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MC-79	Chlorine Leak detector	III				Main Contractor Approved Sources					
MC-80	Density Meter	III				Main Contractor Approved Sources					
MC-81	Electro Magenetic Flow meter	III				Main Contractor Approved Sources					
MC-82	Postive dispalcement Type Flow Meter	III				Main Contractor Approved Sources					
MC-83	Level Scanner (3 D)for Solid Application	III				Main Contractor Approved Sources					
MC-84	Mosaic tiles /Console items	III				Main Contractor Approved Sources					
MC-85	Electrical Control Panel (UCP/Backup)	III				Main Contractor Approved Sources					
MC-86	Electrical Indicating Instruments (Mosaic Compatible)	III				Main Contractor Approved Sources					
MC-87	OWS/EWS/Server	III				Main Contractor Approved Sources					
MC-88	Bio Matrix Reader	III				Main Contractor Approved Sources					
MC-89	ANPR	III				Main Contractor Approved Sources					
MC-90	UVSS	III				Main Contractor Approved Sources					
MC-91	Comd & Control System	III				Main Contractor Approved Sources					
MC-92	Access & Controller Software	III				Main Contractor Approved Sources					
MC-93	IR LED based Illuminator	III				Main Contractor Approved Sources					
MC-94	ATB Bolloard	III				Main Contractor Approved Sources					
MC-95	Boom Barrier	III				Main Contractor Approved Sources					
MC-96	Touchless biomatric recorder	III				Main Contractor Approved Sources					
MC-97	GPS Sensor based Vehicle Monitoring system	III				Main Contractor Approved Sources					
MC-98	10mp digital camera with tripod for photo capture	III				Main Contractor Approved Sources					
MC-99	2D GIS map application	III				Main Contractor Approved Sources					
MC-100	Audible alarm device	III				Main Contractor Approved Sources					
MC-101	CameraPoles	III				Main Contractor Approved Sources					
MC-102	Card Reader	III				Main Contractor Approved Sources					
MC-103	Door Frame Metal Detector -DFMD	III				Main Contractor Approved Sources					
MC-104	Door sensor	III				Main Contractor Approved Sources					
MC-105	Egress Switch	III				Main Contractor Approved Sources					
MC-106	EM LOCK	III				Main Contractor Approved Sources					
MC-107	Emergency exit / door override switch	III				Main Contractor Approved Sources					
MC-108	Emergency Siren /Hooter	III				Main Contractor Approved Sources					
MC-109	Flap barrier	III				Main Contractor Approved Sources					
MC-110	Flash Lights for covering perimeter area for clear view from PTZ in night time	III				Main Contractor Approved Sources					
MC-111	Geo fencing	III				Main Contractor Approved Sources					
MC-112	Glass Break switch at Emergency Exit	III				Main Contractor Approved Sources					
MC-113	Guard tour	III				Main Contractor Approved Sources					
MC-114	Half Height Turnstile	III				Main Contractor Approved Sources					
MC-115	Handheld Walkie - Talkie	III				Main Contractor Approved Sources					
MC-116	HHMD	III				Main Contractor Approved Sources					
MC-117	Long Range RFID Reader	III				Main Contractor Approved Sources					
MC-118	Monitors 24 Inch Full HD	III				Main Contractor Approved Sources					
MC-119	Network Panel	III				Main Contractor Approved Sources					
MC-120	Optical Time Domain Reflector-meter (OTDR) with all accessories	III				Main Contractor Approved Sources					
MC-121	Panic Button with Audible Alarm	III				Main Contractor Approved Sources					
MC-122	Panic button/SOS button supportin SIP protocol	III				Main Contractor Approved Sources					
MC-123	RFID based Stickers	III				Main Contractor Approved Sources					
MC-124	Sliding Gate	III				Main Contractor Approved Sources					

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MC-125	SMS gateway	III				Main Contractor Approved Sources					
MC-126	Storage Device (SAN/NAS/DAS) of 100 TB each	III				Main Contractor Approved Sources					
MC-127	Traffic Light	III				Main Contractor Approved Sources					
MC-128	Turnstile - half height	III				Main Contractor Approved Sources					
MC-129	SPIKE BARRIER	III				Main Contractor Approved Sources					
MC-130	CHAIN LINK FENCE	III				Main Contractor Approved Sources					
MC-131	X-ray Baggage Scanner	III				Main Contractor Approved Sources					
MC-132	Static Radio Set	III				Main Contractor Approved Sources					
MC-133	EPABX equipments	III				Main Contractor Approved Sources					

LEGENDS :

1.0 SYSTEM SUPPLIER / SUB SUPPLIER APPROVAL STATUS CATEGORY

A - For those items proposed vendor is acceptable to Customer. To be indicated with letter "A" in the list alognwith the condition of approval, if any.

2.0 QP INSPECTION CATEGORY :

CAT - I : For those items the Quality Plans are approved by Customer and final acceptance will be on physical inspection witness by Customer

CAT - II : For those items the Quality Plans are approved by Customer. However no physical inspection shall be done by Customer. The final acceptance by Customer shall be on the basis of review of documents.

CAT - III :For these items Quality control to be exercised as per Main contractor Quality Assurance System. The final acceptance by NTPC shall be on the basis of Certificate of Conformance (COC) by Main Contractor.

UNITS/WORKS : Place of manufacturing- Place of main supplier of multi units/works.

NOTE - 1 : A: Vendors to submit project specific documents as per Sub-QR requirements in case the Vendor is approved under collaboration agreement.
B: In case approved sub vendor is offering product with latest model/series apart from earlier approved, vendors to submit project specific documents as per Sub-QR requirements.

NOTE - 2 : For Insrument cable <= 1 KM inspection category CAT - III, For > 1 KM to <= 10 KM Inspecton category CAT - II COC & FOR> 10 KM Inspection category CAT-I

NOTE -3 : For Fiber Optic cable <=10KM inspection category CAT - III & for > 10KM Inspection category CAT-II

NOTE-4 : Batteries for UPS <= 10 KVA and batteries for intelligent battery charger 24 V DC <= 40 Amp inspection category CAT-III & for Batteries for UPS> 10KVA and batteries for intelligent battery charger 24 V DC > 40 Amp rating

NOTE-5 UPS <= 10 KVA rating inspection category CAT-III & for > 10KVA rating inspection category CAT-I

NOTE - 7 - EMPTY CABINETS, COMPUTERS, SIGNAL ISOLATOR/ MULTIPLIER and TB SHALL ALSO BE ACCEPTABLE FROM OWNER ACCPETED IN QP. IF THE TOTAL INTEGRATED PANEL AND FAT IS CONDUCTED INDEGENEOUSLY

NOTE-8 : For the C & I instrumnts mounted on the skid of the main item or supplied as a integral part of the main item, instrument to be supplied as per proven practice of the manufacturer meeting the Customer technical specification

NOTE-9- This item is a bought out componenet of main equipments like DDCMIS ,PLC,TSI,CCTV ,PA system etc

NOTE-10- For these controlled items, vendor shall be proposed for owner accpetance with-in the agreed contract schedule of the package

NOTE-11 - Major Bought-Out-Items are to be procured from LOA approved sources & the same shall be finalized during the finalization of Manufacturing Quality Plan . MQP shall be duly vetted by OEM with their project specific authorisation letter .

NOTE-12 : Main contractor apporved sub vendors are acceptable those are evaluated / assesesed as per Main contractor Quality Management System for vendor approval. Main contractor to inform the finaly selected vendor to NTPC as soon as PO is placed for these items. In case of sub-QR Note-1 is also applicable.

SUB VENDORS LIST (CONTINUED)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	PRESSURE VESSELS	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.	ATMOSPHERIC/ STORAGE TANKS	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	
3.	RUBBER LINING (AT SHOP)	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	
		EMKAY RUBBER	MUMBAI	
4.	AIR BLOWERS (TWIN	SWAN PNEUMATIC	NOIDA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
	LOBE TYPE)	EVEREST TRANSMISSION	NEW DELHI	
		KAY INTERNATIONAL	NEW DELHI / SONEPAT	
		EVEREST BLOWER	BAHADURGARH	
		KULKARNI POWER TOOLS	KOLHAPUR/ PUNE	
5.	METERING PUMPS	VK PUMPS	NASIK	
		MILTON ROY INDIA	CHENNAI	
		SWELLORE	AHMEDABAD	
		METACHEM	MUMBAI	
6.	AGITATOR	REMI PEOCESS PLANT & M/C	MUMBAI	
		FIBRE & FIBRE	MUMBAI / SILVASA	
		CEECONS	CHENNAI	
		STANDARD ENGINEERS	MUMBAI	
7.	HORIZONTAL CENTRIFUGAL PUMPS	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.	VERTICAL CENTRIFUGAL PUMPS	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	
9.	SCREW PUMP	UT PUMP		
		ROTO PUMPS		
		TUSHACO		
10.	HORIZONTAL CENTRIFUGAL PUMPS (RUBBER LINED)	KISHORE PUMPS	PUNE	
		SU MOTORS	MUMBAI	
11.	NON METALLIC (PP/FRP) HORIZONTAL CENTRIFUGAL PUMPS	ENGINEERS COMBINE	THANE	
		ANTICORROSIVE	VALSAD	
		LEAK PROOF PUMPS PVT. LTD. (RAJEDIA)	-	
12.	MISC. PUMP VERTICAL	KBL	PUNE	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
	TURBINE TYPE	M&P	PUNE	
		WPIL	GHAZIABAD	
		KISHORE PUMPS	PUNE	
		FLOWMORE	SAHIBABAD	
13.	**UNDER BED NOZZLE**	JONSONS SCREEN	AUSTRALIA/ IRELAND	
14.	**COATING & WRAPPING MATERIAL TAPE**	IWL LTD.	CHENNAI	
		MP TAR PRODUCT	BHILAI	
		PORWAL INDUSTRIES	RAIPUR	
		RUSTECH	KOLKATA	
		STP	JAMSHEDPUR	
15.	**HEATER**	ESCORTS	FARIDABAD	
		RACOLDS	FARIDABAD	
16.	**CLARIFIER/ THICKENER MECHANISM**	CLEAR WATER	DELHI	
		TRIVENI	NOIDA	
		PBJ ASSOCIATE	PUNE	
17.	**CENTRIFUGE**	HUMBOLT	-	
		HILLER	-	
18.	**CAST IRON GATE/GLV/NRV/SRV**	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	
19.	**BALL VALVE (MANUAL /PNEUMATIC/ ELECTRIC) CLASS 150**	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	
		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	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		VALTECH INDUSTRIES	MUMBAI	
		VAAS AUTOMATION PVT. LTD.	NEW DELHI	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
20.	ELECTRIC MOTOR	CROMPTON GREAVES	AHMEDNAGAR	
		LAXMI HYDRAULICS PVT. LTD	BANGALORE / HUBLI*	
		RAJINDRA ELECT INDUSTRIES	FARIDABAD* / BANGALORE	
		GE-POWER		
		BHARAT BIJLEE	MUMBAI	
		SIEMENS	MUMBAI	
		NGEF	BANGALORE	
		KIRLOSKAR ELECTRIC CO LTD.		
		ASEA BROWN BOVERI		
		MARATHON	KOLKATA	
21.	BUTTER-FLY VALVE	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	
22.	DIAPHRAGM VALVE (MANUAL / PNEUMATIC) CLASS 150	WEIR BDK	HUBLI	
		CRANE FLOW PROCESS	SATARA	
		PROCON	MUMBAI	
		MAJESTIC VALVES (LABLINE)	-	
		HAWA ENGINEERS	AHMEDABAD	
23.	DUAL PLATE CHECK VALVES	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 150 & UP TO 500NB

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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.
24.	Y-TYPE STRAINER	OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		GRAND PRIX	NEW DELHI	
		JAYPEE	NEW DELHI	
		GREAVES COTTON	MUMBAI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI / NOIDA	
		FILTERATION ENGINEERS (I) PVT. LTD	MUMBAI	
		FLUIDNYE	-	
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		BHATIA ENGINEERING CO.	DELHI	
25.	RUBBER FLAP TYPE CHECK VALVES	ASHVIK VALVES	-	
		FLOW WAY VALVES	-	
		BDK	-	
		MAJESTIC VALVES (LABLINE INST)	-	
		ADVANCE VALVES	-	
26.	SOLENOID VALVES	ROTEX	-	
		AVCON	-	
27.	PRESSURE GAUGE/ DIFFERENTIAL PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	KOLKATA	
		ASHCROFT INDIA PVT LTD.	GUJARAT	
		BOSE PANDA INSTRUMENTS PVT.LTD.	KOLKATA	
		FORBES MARSHALL (HYD) LTD.	HYDERABAD	
		GAUGE BOURDON INDIA PVT. LTD.	MUMBAI	
		H.GURU INDUSTRIES	KOLKATA	
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGALORE	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	
28.	CHAIN PULLEY BLOCK	ARMSEL MHE PVT. LTD	BANGALORE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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,	
		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	
29.	ELECTRIC HOIST	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	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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	
30.	CONTROL VALVE	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	
		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	
31.	PRESSURE/DP/VACUUM SWITCH	INDFOSS	GHAZIABAD	
		SOR	USA	
		DRESSOR	USA	
		DELTA CONTROL	UK	
		TRAFAG	RANIPET	
		GIC(GAUGES BOURDON)	PANVEL	
		ASHCROFT INDIA PVT LTD.	USA/GERMANY	
		SWITZER	CHENNAI	
32.	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	KOLKATA	
		ASHCROFT INDIA PVT LTD.	GUJARAT	
		BUDENBERG GUAGE CO.LTD.	UK	
		FORBES MARSHALL (HYD) LTD.	HYDERABAD	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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	
33.	LEVEL GAUGE (F&B, TUBULAR, REFLEX)	SBEM		
		CHEMTROL		
		PUNE TECHTROL		
		SIGMA		
		V AUTOMAT		
		GENERAL INSTRUMENTS		
34.	ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	PUNE	
		FLOW STAR ENGINEERING PVT. LTD.,	FARIDABAD	
		FLOWTECH INSTRUMENTS SERVICRS	VADODARA	
		INSTRUMENTATION ENGINEERS PVT LTD	TELANGANA	
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI	
35.	LEVEL SWITCH-CONDUCTIVITY TYPE	BLISS ANAND PVT. LTD.	GURGAON	
		FLOWTECH INSTRUMENTS SERVICRS	VADODARA	
		HI-TECH SYSTEMS & SERVICES LTD.	KOLKATA-	VENDOR SHALL SOURCE IMPORT CONTENTS OF LEVEL SWITCH (CONDUCTIVITY TYPE) FROM LEVELSTATE SYSTEMS LTD., UNITED KINGDOM.
		LEVCON INSTRUMENTS PVT. LTD.	KOLKATA	
		RAMAN INSTRUMENTS PVT.LTD.	MUMBAI	VENDOR SHALL SOURCE IMPORT CONTENTS OF LEVEL SWITCH (CONDUCTIVITY TYPE) FROM MOBREY MEASUREMENT, AN OPERATING UNIT OF

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
				MORBEY LTD., SLOUGH, BERKSHIRE, UNITED KINGDOM.
		SIGMA INSTRUMENTS CO.	MUMBAI	
		SOR INC.	USA	
		SAPCON INSTRUMENT PVT LTD.	INDORE	
		V. AUTOMAT & INTRUMENTS (P) LTD.	NEW DELHI	
36.	LEVEL SWITCH (ALL TYPES)	LEVCON		
		CHEMTROLS SAMIL (INDIA) PVT LTD.		
		SWITZER		
		WAAREE (BAUMER INSTRUMENTS)		
		V AUTOMAT		
		PUNE TECHTROL		
37.	MAGNETIC FLOW METER	ABB	-	
		WAAREE (BAUMER INSTRUMENTS)	-	
		EUREKA	-	
		EMERSON	-	
		YOKOGAWA	-	
		HACH (POTENSE)	-	
		KROHNE MARSHALL	-	
38.	FLOW ELEMENT - NOZZLE	HYDROPNEUMATICS PVT. LTD.	GOA	
		INSTRUMENTATION LTD.	PALAKKAD	
		MICRO PRECISION PRODUCTS PVT. LTD.	FARIDABAD	
		MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	GOA	
		STAR-MECH CONTROLS (I) PVT.LTD.	PUNE	
		SEIKO FLOW CONTROL GMBH	AUSTRIA	
39.	FLOW ELEMENT - ORIFICE	FLOW STAR ENGINEERING PVT. LTD.,	FARIDABAD	
		HYDROPNEUMATICS PVT. LTD.	GOA	
		INSTRUMENTATION LTD.	PALAKKAD	
		INSTRUMENTATION ENGINEERS PVT LTD	HYDERABAD	
		MICRO PRECISION PRODUCTS PVT. LTD.	FARIDABAD	
		MINCO (INDIA) PRIVATE LIMITED	GOA	
		STAR-MECH CONTROLS (I) PVT.LTD.	PUNE	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
40.	FLOW TRANSMITTERS (ALL TYPES)	E & H	-	
		KHRONE MARSHALL	-	
		EMERSON	-	
		ABB	-	
		HONEYWELL	-	
		YOKOGAWA	-	
41.	LEVEL TRANSMITTERS (ALL TYPES)	EMERSON	-	
		E & H	-	
		ABB	-	
		HONEYWELL	-	
		V AUTOMAT	-	
		YOKOGAWA	-	
		SIEMENS	-	
		KROHNE MARSHALL	-	
42.	PRESSURE TRANSMITTERS (ALL TYPES)	EMERSON	USA/PAWANE	
		LAXONS AUTOMATION	DAMAN	
		YIL	BANGALORE	
		SIEMENS	THANE	
		FUJI	CHINA	
		YOKOGAWA	JAPAN	
		HONEYWELL	USA/PUNE	
43.	TEMPERATURE TRANSMITTERS	EMERSON	-	
		E & H	-	
		ABB	-	
		HONEYWELL	-	
		V AUTOMAT	-	
		YOKOGAWA	-	
		SIEMENS	-	
		FORBES MARSHALL	-	
44.	PH TRANSMITTERS	EMERSON	-	
		YOKOGAWA	-	
		HONEYWELL	-	
		ABB	-	
		HACH	-	
		FORBES MARSHALL	-	
45.	ANALYSERS (ALL TYPES)	ABB	-	
		EMERSON	-	
		YOKOGAWA	-	
		HONEYWELL	-	
		HACH POLYMETRON	-	
		SIEMENS	-	
		FORBES MARSHALL	-	
46.	PROGRAMMABLE LOGIC CONTROLLER	GE INTELLIGENT PLATFORMS PRIVATE LIMITED	BANGALORE	
		HONEYWELL AUTOMATION INDIA LIMITED ,	PUNE	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ROCKWELL AUTOMATION INDIA LTD	SAHIBABAD	
		SIEMENS LIMITED	MUMBAI	
		SCHNEIDER ELECTRIC INDIA PVT.LTD.	NEW DELHI	
47.	UPS	HITACHI-HIREL	GANDHINAGAR	
		APC	BANGALORE	
		DELTA	GURGAON	
		EMERSON	MUMBAI	
		DB POWER	PUNE	
		APLAB	MUMBAI	
48.	INSTRUMENT FITTINGS	AURA INCORPORATED	NEW DELHI	
		ASTEC VALVES & FITTINGS PVT. LTD.,	MUMBAI	
		ARYA CRAFTS & ENGINEERING PVT. LTD.	MUMBAI	
		COMFIT & VALVE PVT. LTD.	GUJARAT	
		FLUIDFIT ENGINEERS PVT. LTD.	MUMBAI	
		FLUID CONTROLS PVT. LTD.	MUMBAI	
		HP VALVES & FITTINGS INDIA PVT. LTD.	CHENNAI	
		PRECISION ENGINEERING INDUSTRIES	MUMBAI	
		PANAM ENGINEERS,	MUMBAI	
		PERFECT INSTRUMENTATION CONTROL (INDIA) PVT. LTD.	MUMBAI	
		VIKAS INDUSTRIAL PRODUCTS	NOIDA	
49.	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	MUMBAI	
		FLEXPRO ELECTRICALS PVT. LTD.	GUJARAT	METAL TYPE JUNCTION BOX ONLY
		K.S.INSTRUMENTS PVT.LTD.	BANGALORE	
		SUCHITRA INDUSTRIES	BANGALORE	
		SHRENIK & COMPANY,	AHMEDABAD	
50.	CABLE GLAND	COMET	-	
		DOWELL	-	
		CHETNA	-	
51.	CABLE LUGS	ELECTRO BILLETS	-	
		COMET	-	
		DOWELL	-	
		CHETNA	-	
52.	MS PLATES	SAIL		
		ESSAR STEEL		
		TISCO		

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		RINL		
		JINDAL		
		LLOYD		
		ISPAT		
		INDIAN IRON & STEEL CO. LTD		
53.	CS PIPE (ASTM A 106 GR. B)	INDIAN SEAMLESS METAL TUBES	AHMEDABAD	UPTO 150 NB
		MAHARASHTRA SEAMLESS	RAIGAD	UPTO 350 NB
54.	MS PIPES	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	SIKRANDRABAD	
		GOOD LUCK TUBES	SIKANDRABAD	
		ADVANCE STEEL TUBES	SAHIBABAD	
		BIHAR TUBES	SIKANDRABAD	
		HI TECH PIPES	SIKANDRABAD	
		RATNAMANI	KUTCH/AHMEDABAD/CHHATRAL	
		MAHARASHTRA SEAMLESS	RAIGAD	
		WELSPUN	ANJAR/BHARUCH	
55.	SS PIPES/ TUBES	APEX TUBES	BEHROR (ALWAR)	
		RATNAMANI	CHATTRAL	
		REMI	TARAPUR	
		PRAKASH STEELAGE	-	
56.	POWER/CONTROL/INSTRUMENT CABLE	CORDS CABLE	BHIWADI	
		RADIANT CABLES	HYDERABAD	
		POLYCAB	DAMAN	
		KEI	BHIWADI	
		NICCO	KOLKATA	
		RAVIN CABLES	PUNE	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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	
57.	SAFETY SHOWER	UNICARE	-	
		MOHAN INDUSTRIES	-	
		SUPER SAFETY SERVICES	-	
58.	FRP TANKS & FITTINGS	GLOBAL COMPOSITE	-	
		EPP	-	
		DEEPA COMPOSITE	-	
		COROSEAL INDUSTRIES	-	
		CHEMICAL PROCESS & EQUIPMENT PVT LTD	-	
		J.R FIBRE INDUSTRIES PVT LTD	-	
		POLYPLAST	-	
59.	EJECTOR	ESSEM TECHNOLOGIES	-	
		RATNA PRASAD	-	
60.	LOCAL CONTROL PANEL	INDUSTRIAL SWITCHGEAR & CONTROL	-	
		POSITRONICS	-	
		DELTA CONTROL	-	
		L & T	-	
		GE POWER	-	
		PYROTECH	-	
		C& S	-	
61.	TANK (FRP)	INDUSTRIAL SERVICE	KOLKATA	
		SUNRISE	BARODA	
		GANDHI & ASSOCIATES	AHMEDABAD	
		MODERN EQUIPMENTS	CHENNAI	
		EAGLE PLAST	PUNE	
		OMEGA PLAST	MUMBAI	
62.	STROKE CONTROLLER	V K PUMPS	NASIK	
		METACHEM	MUMBAI	
		SWELORE	AHMEDABAD	
		MILTON ROY INDIA	CHENNAI	
63.	SAFETY VALVES/RELIEF VALVES	METACHEM	MUMBAI	
		KEYSTONE	BARODA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		V K PUMPS	NASIK	
		MILTON ROY	CHENNAI	
64.	DUPLEX STRAINER	JAYPEE INDUSTRIES PVT. LTD.	NEW DELHI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI	
		OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		SUNGOV ENGINEERING PVT. LTD.	CHENNAI	
65.	ORIFICE PLATE	MICRO PRECISION	FARIDABAD	
		INSTRUMENTAION LTD	PALGHAT	
		CARLO DYNAMICS	HYDERABAD	
66.	STEEL GATE/GLOBE/NR VALVES	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)
		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 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.	KOLKATA	CC/CSS-GATE-

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		WORKS		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	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900,GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
67.	SLUICE GATE	H SARKAR	KOLKATA	
		JASH ENGINEERING	-	
		YASHWANT INDUSTRIES	-	
68.	3 WAY VALVE	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	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
69.	PLUG VALVE(MANUAL)	BDK	HUBLI	
		HAWA ENGINEERS / MARCK & CARE	-	
		MICON VALVES	-	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
70.	FITTINGS (CS/SS)	M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	
		RELIANCE FORGE	MUMBAI	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
71.	FLANGES (SS/CS)	RELIANCE FORGE	MUMBAI	
		TUBE PRODUCT INCOROPORATION	BARODA	
		MS FITTINGS	KOLKATA	
		HAWA ENGINEERING	-	
		ALIANCE PIPE & PLANGES	KOLKATA	
		JAI AMBE	MUMBAI	
72.	PIPE & FILLTING (PP, HDPE, PVC & CPVC)	GEROGE FISHCHER	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
73.	VALVES (GATE/GLOBE/NRV/BALL)- (PP, HDPE, PVC & CPVC)	GEROGE FISHCHER IPING SYSTEMS PVT LTD	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
74.	AIR FILTER REGULATOR	SHAVO NORGEN	-	
		PLACKA INSTRUMENTS	-	
75.	FILTER MEDIA	GLOBAL ABSORBENT	KOLKATA	
		BHARAT MINERALS		
76.	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	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
77.	DC LEAD ACID BATTERIES	EXIDE INDUSTRIES LTD	NEW DELHI	
		HBL POWER SYSTEMS LTD	HYDERABAD	TUBULAR TYPE
		HOPPECKE BATTERIEN GMBH & CO.KG,	GERMANY	
78.	DC NI CD BATTERIES	AMCO SAFT INDIA LTD	BANGALORE	
		HBL POWER SYSTEMS LTD	HYDERABAD	
		HOPPECKE BATTERIEN GMBH & CO.KG,	GERMANY	
79.	SIGHT FLOW INDICATORS	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	
80.	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		
81.	PNEUMATIC ACTUATOR	PROCON ENGINEERS	-	
		TYCO	-	
		CRANE PROCESS	-	
		BDK	-	
		INTERVALVE	-	
		BRAY CONTROL	-	
82.	MOTORISED ACTUATOR	ROTARK	-	
		AUMA	-	
		LIMITORK	-	
83.	UF MEMBRANE	DOW	-	
		HYFLUX	-	
		GE	-	
		MEMBRANE HITECH	-	
84.	RO MEMBRANE	DOW CHEMICALS – FILMYECH	USA	
		HYDRANAUTICS	USA	
		KOCH MEMBRANE- FLUID	USA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		SYSTEM		
		TOREY	JAPAN	
85.	RO PRESSURE TUBES (FRP)	PENTAIR WATER	GOA	
86.	MBR MEMBRANE	KOCH		
		GE		
		TOREY		
87.	CHEMICAL DOSING SYSTEM	V K PUMPS	MUMBAI	
		MILTON ROY	CHENNAI	
		TECHNO CONSULTANTS	MUMBAI	
		POSITIVE METERING PUMPS (I) PVT. LTD.	NASIK	
		PSI ENGINEERING SYSTEMS (P) LTD.	CHENNAI	
		PRORITES EQUIPMENTS PVT. LTD.	PUNE	
		DENCIL PUMPS & SYSTEMS PVT. LTD.	MUMBAI	
		POWER PIPING COMPANY	TRICHY	
		ROCKWIN FLOWMETER INDIA PVT. LTD.	GHAZIABAD	
		SR METERING PUMPS AND SYSTEMS	NASHIK	
		SWELORE ENGG. PVT. LTD	AHMEDABAD	
		UDKAM PROCESS EQUIPMENT INDIA PVT. LTD.	GREATER NOIDA	
		VASU CHEMICALS LLP	MUMBAI	
88.	OXYGEN DOSING SYSTEM	FORBES MARSHALL PVT. LTD	PUNE	
		POSITIVE METERING PUMPS (I) PVT. LTD.	NASIK	
		PSI ENGINEERING SYSTEMS (P) LTD.	CHENNAI	
		V.K PUMP INDUSTRIES PVT LTD	MUMBAI	
		POWER PIPING COMPANY	TRICHY	
		M R SYSTEMS	HOWRAH	
		ENPRO INDUSTRIES	PUNE	
		UNITED ENGINEERING AND TECHNOLOGIES PVT. LTD.	PUNE	
		NEOMETRIX ENGINEERING PVT. LTD.	NOIDA	
89.	LIME DOSING SYSTEM	INDIANA CONVEYORS PVT LTD	MUMBAI	
		HYQUIP SYSTEMS LTD	HYDERABAD	
		EQUIPMENT ENGINEERS PRIVATE LIMITED	KOLKATA	
		MAHINDRA TSUBAKI CONVEYOR SYSTEMS PRIVATE LIMITED	PUNE	
		INDUS ENGINEERING PROJECTS	NEW DELHI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		INDIA/ INDUS ENGINEERING PROJECTS INDIA PVT. LTD.		
		MACAWBER BEEDKAY PVT LTD.	NOIDA	
		M/S HV EQUIPMENTS PVT LTD.	NOIDA	
		M/S POLLUCON ENGINEERING SERVICES	FARIDABAD	
		KHD HUMBOLDT WEDAG	NEW DELHI	
		PSI ENGINEERING SYSTEMS (P) LTD.	CHENNAI	
		RIECO INDUSTRIES LTD.	PUNE	

NOTE:

1. The sub vendor list above is indicative only and is subject to BHEL and Customer (NTPC) approval during detailed engineering stage without any commercial & delivery implication to BHEL.

   Bidder to propose sub vendor list with following back up documents within 8 weeks of placement of LOI. Thereafter no request for additional sub-vendor shall be entertained. The sub vendor list shall subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

   a) Documentation to show that the equipment /system has been supplied for a plant of similar or higher capacity.
   b) End user performance certificate that the equipment/system has been operating satisfactorily for minimum two years as on the scheduled date of bid opening.

   Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

2. The inspection category will be intimated after award of contract by BHEL/customer (NTPC). However, the same will be adhered by the bidder without any commercial and delivery implication to BHEL/ customer (NTPC).

ANNEXURE – III

FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES

PERFORMANCE GUARANTEES

A. General Requirements

1. The Bidder shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in this specification.
2. The guaranteed performance parameters indicated/furnished by the bidder in his offer, shall be without any tolerance values whatsoever and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.
3. The Bidder shall conduct performance test and demonstrate all the guarantees covered herein, during performance guarantee/ acceptance test. The various tests which are to be carried out during performance guarantee/acceptance test are listed in this Sub-section. The guarantee tests shall be conducted by the Bidder at site in presence of NTPC on each unit individually.
4. All costs associated with the tests including cost associated with the supply, calibration shall be included in the bid price.
5. It is the responsibility of the Bidder to perform the Performance Guarantee/ Acceptance test as specified in this subsection. At all times during the Performance Tests effluents from the Plant shall not exceed the Guaranteed Effluent Limits.
6. The Bidder shall make the plant ready for the performance guarantee tests before start of Initial Operation.
7. Instruments for PG test and instruments for process control of similar applications are envisaged to be of same make and model having same accuracy level. However, instruments for PG test are also acceptable as per standard and proven practice of the Bidder/ OEM and in such case, instruments for process control shall be as per requirements. Instruments to be used for PG test shall be additionally supplied over and above the instruments shown in tender P&IDs. PG test equipment being supplied, installed and commissioned for each unit, shall be retained by NTPC after completion of PG test.

   Control system loop tuning required to limit the variation of parameters during performance guarantee testing shall be completed prior to PG Test / initial operation.

8. All PG test process parameters shall be made available in DDCMIS.
9. Tools and tackles, instruments/devices including flow devices, matching flanges, impulse piping & valves etc. and any special equipment, required for the successful completion of the tests, shall be provided by the Bidder free of cost.
10. The Performance / Acceptance test shall be carried out as per the standard procedure included in the specification. For some of the PG tests, standard PG test procedures have not been included in the specification. PG test procedure for such PG tests shall be submitted by bidder, as per latest International codes / standard meeting the specification requirements along with sample calculations & detailed activity plan of preparation (including test instrumentation), conductance and evaluation of Guarantees after Award:

    1. For Cat-I Performance / Acceptance tests to be conducted along with the initial operation: After the conductance of Performance test, the test results shall be calculated in Bidder's PG test program. The correction curves shall be fed/ inbuilt in the PG test program. Provision of manual entry of offline data which cannot be captured online and necessary for calculation of PG Test result shall also be provided. The Bidder shall submit the detailed test evaluation report of Performance test results to NTPC/ BHEL promptly but not later than 7 days from the date of conductance of Performance test.

    2. For Performance / Acceptance tests other than those identified at 1 above: After the conductance of Performance test, the Bidder shall submit the test evaluation report of Performance test results to NTPC/ BHEL promptly but not later than 7 (seven) days from the date of conductance of Performance test. However, preliminary test reports shall be submitted to the NTPC/ BHEL after completing each test run.

11. The Bidder shall submit for NTPC's approval the detailed Performance Test procedure (except for the guarantee tests for which the standard PG test procedure is identified in technical specification) containing the following:
    a. Object of the test.
    b. Various guaranteed parameters & tests as per contract.
    c. Method of conductance of test and test code.
    d. Duration of test, frequency of readings & number of test runs.
    e. Method of calculation.
    f. Correction curves and respective equations for graphs to be fed for the online computation.
    g. Instrument list consisting of range, accuracy, least count, and location of instruments along with reference approved P&IDs.
    h. Scheme showing measurement points.
    i. Sample calculation.
    j. Acceptance criteria.
    k. Any other information required for conducting the test.

12. In case during performance guarantee tests it is found that the equipment/system has failed to meet the guarantees, the Bidder shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the NTPC/ BHEL and re-conduct the performance guarantee test(s) with NTPC/ BHEL's consent. However, if the specified performance guarantee(s) are still not met even after the above modifications/ replacements within ninety (90) days or a reasonable period allowed by the NTPC/ BHEL, after the tests have been completed NTPC/ BHEL will have the right to the following:

a. For Category-I Guarantees

Accept the equipment/system/plant after levying Liquidated Damages as specified hereunder. The liquidated damages, for shortfall in performance indicated elsewhere in this specification and shall be levied separately for each unit, except for the rate indicated for auxiliary power consumption for station auxiliaries which is on station basis. The liquidated damages shall be prorated for the fractional parts of the deficiencies. The performance guarantees coming under this category shall be called 'Category – I' Guarantees.

b. For Category-II Guarantees

In case the performance guarantee(s) are not met by the Bidder during demonstration test, the Bidder shall carry out all necessary modifications and/or replacements to comply with the guaranteed requirements at no extra cost to the NTPC/ BHEL and re-conduct the performance guarantee test(s) with NTPC/ BHEL's consent.

If, however, the demonstrated guarantee(s) are not met even after the above modifications / replacements within ninety (90) days, it will be concluded that, the equipment has failed to meet the guarantee(s). In such a case, NTPC/ BHEL shall Reject the equipment/ plant/ system and recover from the Bidder the payments already made. The performance guarantees under this category shall be called 'Category - II ' Guarantees. Conformance to the performance requirements under Category -II is mandatory.

c. For Category-III Guarantees

Accept the equipment/ system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the NTPC/ BHEL. Such damages shall, however be limited to the cost of replacement of the equipment(s) / system(s) replacement of which shall

remove the deficiency so as to achieve the guarantee performance. These parameters/ capacities shall be termed as category - III, guarantees.

B. Guarantees Category of Water treatment packages

1. GUARANTEES UNDER CATEGORY I: NIL

2. GUARANTEE UNDER CATEGORY –II

Noise

All the water treatment packages, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency specified in General Technical Requirement.
Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 61672-1 & 2 (latest edition) Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/ machine and at a height of 1.5 m above the floor level in elevation.
A minimum of 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on the A - weighting scale. The average of A-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed the guaranteed value. Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.

3. GUARANTEE UNDER CATEGORY –III

The parameters/capabilities to be demonstrated for various systems/ equipment shall include but not be limited to the following:

3.1 PRE-TREATMENT PLANT

A. CLARIFICATION PLANT

i. Each clarifier unit of PT-CW system & PT-DM system shall be guaranteed for design effluent capacity meeting the effluent quality as mentioned below.
ii. Effluent quality at the outlet of clarifiers (PT-CW system & PT-DM system) shall be guaranteed for the following:
- Organic Matter : Less than 0.05 mg/l (see note below)
- Iron Content : Less than 0.3 mg/l
- Turbidity : Less than 10 NTU
- TSS : Less than 10 ppm

Note: Organic matter shall be tested as per KmnO4 method.
iii. Each clarifier shall be tested to demonstrate the above-mentioned Guarantees at site under P&G test. In addition, demonstration of satisfactory working of all the clarifiers, its drives, scrapper mechanism, operation of sludge blow-off etc., shall be demonstrated.

B. FILTRATION PLANT

i. Each Gravity filter for PT-DM system shall be guaranteed for design capacity meeting the effluent quality below with one backwash and air scouring in not less than 24 hours or more. Backwash water requirement not to exceed 2% of the water treated between two successive backwashes.

ii. Each Gravity filter for PT-Potable system shall be guaranteed for design capacity meeting the effluent quality below with one backwash and air scouring in not less than 24 hours or more. Backwash water requirement not to exceed 2% of the water treated between two successive backwashes.

iii. Turbidity at outlet of each gravity filter of PT-DM and PT-Potable system shall not exceed 2 NTU with inlet turbidity of up to 10 NTU.

iv. TSS at outlet of each gravity filter of PT-DM and PT-Potable system shall not exceed 2 PPM with inlet TSS of up to 10 PPM.

v. Each filter shall be tested to demonstrate the above-mentioned Guarantees at site under P&G test. In addition, demonstration of satisfactory working of all the filters, its backwashing operation, operation of various valves etc shall be demonstrated by Contractor.

3.2 EFFLUENT TREATMENT PLANT

TUBE SETTLERS/ LAMELLA CLARIFIERS

i. Each Tube Settlers/Lamella Clarifier shall be guaranteed for design effluent capacity meeting the effluent quality as mentioned below.

ii. Effluent quality at the outlet of Tube Settlers/Lamella Clarifier shall be guaranteed for the following:
- Effluent Turbidity: 10 NTU at design flow
- Effluent Oil & grease: 5 ppm (maximum)

iii. Each Tube settler/Lamella clarifier shall be tested to demonstrate the above-mentioned Guarantees at site under P&G test. In addition, demonstration of satisfactory working of settler/clarifiers, operation of sludge blow-off etc shall be demonstrated by Contractor.

3.3 CHLORINE DI OXIDE DOSING SYSTEM

i. Each CLO2 generator for both PT & CW - Chlorination system shall be guaranteed for the design capacity.

ii. Each chlorine di-oxide generator shall have controllable capacity range of 10% -100% or better.

iii. Contractor shall guarantee minimum 90% yield of CLO2 generation as per US-EPA method.

iv. Quantity of NaClO2 (in kg) for production of per kg of ClO2 in the generator shall be guaranteed.

v. Duration of PG Test of each CLO2 generator shall be 72 Hrs.

3.4 DM PLANT (ION EXCHANGE DM PLANT)

A. ACTIVATED (AC) CARBON FILTERS

a) Each filter shall be guaranteed for the design capacity. A.C. filter shall be backwashed once in 24 hours.
b) Free chlorine content in effluent water shall not be detectable as per latest ASTM
c) procedure.
d) Organic matter in the effluent water shall be below detectable level.
e) Turbidity in the effluent water shall be less than 0.5 NTU.

B. ION-EXCHANGER UNITS

a) Each ion exchange unit shall be guaranteed for design capacity meeting the effluent quality as mentioned below. However, each ion exchange unit shall be guaranteed for a Design flow (net) after meeting the water requirement for various regeneration steps. Service Cycle (Period between two successive regenerations) shall be 12 hours for each stream of cation and anion exchangers and 108 hours for each MB exchanger. Net output from each cation-anion unit between two regenerations shall not be less than Design flow (net) x 12 m3/hr and for mixed bed Design flow (net) x 108 m3/hr of treated water.

b) Chemical consumption of the ion exchange units shall be guaranteed against the regeneration level employed and resin volume provided. Total time requirement for regeneration and backwash operation for each stream (AC filter, cation, and anion) shall not exceed four (4) hours. With mixed bed in regeneration, total time of regeneration of stream shall not exceed six (6) hours. The guaranteed values of chemical consumption shall hold good for chemical conforming to following:

- HCl - As per IS: 265 Tech. Grade
- NaOH – As per IS: 252 Pure Grade available in Flakes or lye form

c) Effluent from the mixed bed unit shall be guaranteed to meet the following requirements, at rated capacity, throughout the period between two successive regenerations:

i.	Reactive Silica not to exceed	: 0.01 ppm as SiO2
ii.	Iron as Fe	: Not detectable as per ASTM (ASTM-D-1068)
iii.	Total Hardness	: Not detectable
iv.	pH Value	: 6.8 – 7.3
v.	Conductivity	: Not more than 0.1 micromhos/cm at 25 deg.C.

d) Effluent from the anion exchanger shall be guaranteed as follows at rated capacity throughout the period between two regenerations:

i.	Reactive silica not to exceed	: Not to exceed 0.2 ppm as SiO2
ii.	Conductivity at 25 deg.C	: Not more than 10 micro mhos/cm

e) Sodium leakage through cation shall not exceed 2 ppm as CaCO3 throughout the period between two regenerations.
f) Effluent from degassifier should not have CO2 content more than 5 ppm.
g) Life of cation resin shall be minimum five (5) years and life of anion resin shall be minimum three (3) years.

C. POLSHING UF SYSTEM

1. Net permeate flow rate from each UF train shall be guaranteed for design capacity meeting the effluent quality as mentioned below.
2. Colloidal Silica shall be < 0.01ppm as SiO2.
3. SDI shall be limited to 3.
4. Life of Ultrafiltration membranes shall be guaranteed for minimum five (5) years.
5. For the guaranteed water quality and the permeate water capacity, UF plant shall give an undiminished recovery of 92% up to the end of 5 years of operation with replacement guarantee of membrane elements.

3.5 DM PLANT (UF+RO+MB PLANT)

The bidder/his sub-vendor shall guarantee that the equipment offered shall meet the ratings and performance requirement stipulated for various equipment covered in this specification. Tests shall be carried out to prove the guaranteed parameters specified here under:

A. All pumps, blowers, degasser & filters shall be guaranteed for capacity, total head and power consumption.
B. Effluent from Degasser tower should not have CO2 content more than 5 ppm.
C. Filtration Capacity of Cartridge (PT system of RO) filters shall be guaranteed meeting the effluent quality and the same shall not be less than specified capacity.

D. ULTRAFILTRATION (UF) SYSTEM

1. Net permeate flow rate from each UF train shall be guaranteed for design capacity meeting the effluent quality as mentioned below.
2. SDI shall be limited to 3.
3. Life of Ultrafiltration membranes shall be guaranteed for minimum five (5) years.
4. For the guaranteed water quality and the permeate water capacity, UF plant shall give an undiminished recovery of 92% up to the end of 5 years of operation with replacement guarantee of membrane elements.

E. REVERSE OSMOSIS (RO) PLANT

1. Net permeate flow rate from each RO train shall be guaranteed for design capacity meeting the effluent quality as mentioned below.
2. TDS of RO permeate shall not be more than 20 ppm at 36 deg C. However, the mixed bed unit (MB) at downstream of RO plant shall be designed for inlet TDS of not less than 25 ppm plus 5 ppm of CO2.
3. For the design water quality and the permeate water capacity, RO plant shall give an undiminished recovery of 85% upto the end of 3 years of operation with replacement guarantee of membrane elements.
4. Performance of Cleaning, Flushing System arrangement shall be demonstrated.
5. Life of RO membranes shall be guaranteed for minimum three (3) years.
6. For power guarantee purpose, RO High Pressure Pumps shall be designed at 20 deg C.

F. MIXED BED UNITS

Effluent from the mixed bed unit shall be guaranteed to meet the following requirements, at rated capacity, throughout the period between two successive regenerations:

1. Reactive Silica not to exceed: 0.01 ppm as SiO2.
2. Colloidal Silica shall be < 0.01 ppm as SiO2.
3. Iron as Fe: Not detectable as per ASTM (ASTM-D-1068)
4. Total Hardness: Not detectable
5. pH Value: 6.8 - 7.3
6. Conductivity: Not more than 0.1 micromhos/cm at 25 deg.C.
7. Mixed Bed shall be regenerated after minimum 30 hours of operation followed by regeneration period not exceeding 6 hours.
8. Life of cation resin shall be minimum five (5) years and life of anion resin shall be minimum three (3) years.

3.6 CW CHEMICAL TREATMENT PLANT

1. The bidder shall guarantee that the program offered shall meet the performance requirements stipulated for CW System. Also, the bidder shall demonstrate the guaranteed chemical consumption proposed in the bid, during the contract period.
2. For the purpose of verifying the guarantees on scale, a deposit monitor/test heat exchanger/fouling monitor shall be provided by the bidder stimulating the condenser operating conditions. The deposit monitor shall be weighed in new and clean condition and then weighed again on monthly basis and after completion of the test period. Prior to commencement of treatment program and after chemical cleaning of condenser tubes, the fouling factor shall be calculated for each condenser of **2 x 800 MW units**. The fouling factor shall also demonstrate the cleanliness of condenser tubes by visual examination of the same.
3. Corrosion coupons reflecting the metallurgy of the system components shall be supplied and installed by the contractor to measure guaranteed corrosion value and corrosion rate shall be determined based on observations on monthly basis after completion of six months.

4. For the purpose of verifying bio fouling in circulating water system, a bio fouling monitor or bio film activity monitor shall be provided by the bidder. The bio fouling shall be determined based on observation on monthly basis and after completion of six months.
5. Duration of PG Test shall be as per proven practice and the performance of various parameters including scale, corrosion, bio-fouling etc shall be monitored and guaranteed by bidder at mutually agreed intervals & period as decided during detailed engineering.
6. Guarantee Values of Scale, Corrosion, Fouling & Bio Fouling
   a. Cumulative Corrosion Rate on Mild Steel < 3 mils/year
   b. Cumulative Corrosion Rate on Stainless Steel < 0.1mils/year
   c. Cumulative Corrosion Rate on Cu/Ni < 0.3 mils/year.
   d. Cumulative Scaling Rate of Internal Tube Surface Area of Condenser <15mg/dm2/year
   e. Fouling Factor: Deterioration in Heat Transfer Coefficient shall not be more than 5% of the original value just before commencement of the treatment program.
   f. TVC (Total Viable Count) (Micro Biological Counts) < 1.2 x 100000 counts/ml of circulating water.
   g. SRB (Sulphate Reducing Bacteria) <100 organisms/100 ml of circulating water.

Bidder shall guarantee the above design parameters in the circulating water system of all the Units of the project.

3.7 CONDENSATE POLISHING PLANT

I. Effluent quality at outlet of each vessel at its rated design flow and design service length between two regenerations (as defined elsewhere).

II. AIR COMPRESSOR UNIT (IF APPLICABLE FOR CPU)
   a) Following shall be demonstrated at shop:
      i. Capacity and discharge pressure of each air compressor.
   b) Following shall be demonstrated at site:
      i. Parallel operation of air compressors
      ii. Dew point of air at the outlet of air-drying plants of instrument air compressor.
      iii. Pressure drop across the air-drying plants of air compressors.
      iv. Vibration level of air compressors, blowers of air-drying plant

3.8 COAL HANDLING PLANT RUN-OFF WATER TREATMENT SYSTEM

1. The System shall be designed for the inlet total suspended solids (TSS) of 100 ppm & turbidity 100 NTU.

2. Each clarifier unit shall be guaranteed for design effluent capacity meeting the effluent quality as mentioned below.

   a. Total suspended solids (TSS) less than and equal to 10 ppm.
   b. Turbidity Less than and equal to 10 NTU.

3.9 SEWAGE TREATMENT PLANT

Minimum outlet quality parameters to be demonstrated by bidder have been included below. However, in case the guaranteed parameters as per the latest MOEF, State pollution control board norms and Local authority requirement, are more stringent than the specified parameters given below, then more stringent outlet parameters must be followed and guaranteed by bidder. The treated sewage quality standards shall be achieved at average sewage flow rates as well as peak sewage flow rates. Duration of PG Test for Sewage Treatmnet Plant (STP) shall be 72 Hrs. During the operation of the plant, the below parameters shall be demonstrated by bidder:

S. No	Description	Value
a.	BOD_5	Less than 10 mg/l
b.	COD	Less than 50 mg/l
c.	TSS	Less than 10 mg/l
d.	pH	7-8
e.	Coliform count	100 counts/ 100 ml
f.	NH4-N	Less than 5 mg/l
g.	N Total	Less than 10 mg/l
h.	Residual chlorine	Not exceeding 0.5 mg/l
i.	Temperature	Ambient

3.10 The parameters/capabilities to be demonstrated for following systems/ equipment's shall be:

i. EOT Cranes: Over load tests, travel and hoist speed checks as per relevant Indian standards IS (latest edition).
ii. Butterfly valves: - The functioning of various Butterfly valves, opening and closing operation as per control logic, accumulator capacity of hydraulic operated valves etc. shall be demonstrated as per the approved design document.

3.11 PUMPS (FOR ALL WATER TREATMENT PACKAGES)

a. Capacity, head, and power consumption of all the pumps at the rated duty point (to be demonstrated and proved at shop with the respective job motors) and to operate in accordance with the approved pump characteristic curves. During the shop test no negative tolerance in the guaranteed capacity, head and efficiency of the pump shall be allowed.

b. Current, Voltage, Motor input Power, Frequency, Speed, Bearing/ Motor winding Temperature, Vibration and noise level of pumps and drives and parallel operation (as applicable) without hunting & abnormal noise and with load sharing within 10% of each other at the rated duty point of pumps shall be demonstrated at site as a part of Performance & Guarantee test.

PG Test Procedure for Condensate Polishing Unit System

1.0 Scope of PG test:

PG Test shall be conducted after successful trial run to establish all the guaranteed parameters/ values for each service vessel:

1.1 Three run under normal condition at rated design flow.
1.2 One run under condenser leak condition at rated design flow.
1.3 Chemical consumption for regeneration as per technical specifications.
1.4 Pressure drop across the polisher service vessel in clean and dirty condition of resin at rated design flow.
1.5 100% Transfer of resins from CPU service vessel to regeneration vessel and vice-versa.
1.6 Performance of all the interlocks provided.
1.7 Noise, vibration levels, protection & interlock and other functional guarantees of different rotating machines and equipment

2.0 GUARANTEES:

The Condensate polishing system shall be designed to maintain the guaranteed effluent quality & length of service runs at normal condition, start-up, and condenser leakage conditions. The guarantees shall be as below:

2.1 INFLUENT AND EFFLUENT WATER QUALITIES FOR CONDENSATE POLISHING PLANT UNDER NORMAL RUN CONDITION:

Sl. No.	IONIC CONCENTRATION (as such)	INFLUENT	EFFLUENT (maximum)
1.	Ammonia, ppb	150	--
2.	Total dissolved solids, ppb	100	20
3.	Silica, ppb	30	5* (refer note below)
4.	Iron, ppb	50	5
5.	Sodium, ppb	10	2
6.	Chlorides, ppb	10	2
7.	pH	8.5-9.0	--
8.	Effluent conductivity after removal of ammonia & amines, µS/cm at 25^0C	---	< 0.10 or less
9.	Suspended matter (Crud), ppb	Not more than 25	<5

Note:

i) Silica value shall be 7 ppb as per resin supplier recommendations in case the temperature of the condensate is 50^0C & above.

ii) Under the above operating and design flow through the polisher units, the un-ammoniated resins shall not reach "ammonia break-point" in less than 30 days (720 hrs) of continuous operation while maintaining the above effluent quality. Whenever specific conductivity starts increasing from 0.1 micro mhos/cm in the effluent, it is deemed that "ammonia break point" is reached.

2.2 TEST UNDER STARTUP CONDITIONS (50 hrs at rated flow):

During startup conditions, the quality of influent shall be as follows:

S.No.	PARAMETER	INFLUENT (Maximum)	EFFLUENT (Maximum)
1.	TDS, ppb	2000	--

2.	Silica, ppb	150	--
3.	Crud, ppb	1000	150

Note:

i) For design purposes, average crud loading shall be considered as 500 ppb

ii) Useful service run between two successive regenerations at design flow rate with above conditions should not be less than 50 hours.

2.3 TEST UNDER CONDENSER LEAK CONDITION:

Under condenser tube leakage condition, the quality of influent shall be as follows:

S.No.	PARAMETER	INFLUENT	EFFLUENT (Maximum)
1.	TDS, ppb	2000	--
2.	Sodium, ppb	--	20
3.	Silica, ppb	--	20

Note:

i) The influent TDS will be in addition to the normal influent load. The anion and cation load in influent design TDS shall be based on circulating water analysis.

ii) Useful service run between two successive regenerations at design flow rate with above conditions should not be less than 50 hours.

2.4 TEST UNDER CONDENSER LEAK CONDITION:

The quantities of hydrochloric acid (as per IS:265, technical grade) required for regeneration of one vessel resin (cation) charge and the quantity of sodium hydroxide (as per IS:252, rayon grade) lye or as flakes required for regeneration of one vessel resin (anion) charge shall be as follows:

S.No.	REGENERANT	QUANTITY (Kgs)
1.	Hydrochloric acid (100%)	125 kg x design cation resin volume (M3)
2.	Sodium hydroxide (100%)	160 kg x design anion resin volume (M3)

2.5 PRESSURE DROP:

At the design flow rate, the maximum pressure drop across the polisher service vessels shall be as follows:

S.No.	PARAMETER	PRESURE DROP AT DESIGN FLOW RATE (Kg/cm^2)
1.	Under clean conditions	2.1
2.	Under dirty conditions	3.5

Note:

i) The pressure drop under clean conditions shall include losses due to entrance & exit nozzles, distributors, under drains, resins and the effluent resin traps.

ii) The pressure drop under dirty conditions shall include the pressure drop across effluent resin traps.

2.6 Transfer of resin from service vessel to regeneration vessel shall be complete (100%).

2.7 During PG test period, all service vessels shall also be checked for their rated design flow.

2.8 Parallel operation of all CPU vessels at total design flow should be checked once in all units during PG test.

3.0 GENERAL REQUIREMENTS:

The clauses as given in GTR (General technical requirements), Technical specifications and Notification of award shall be final and binding.

3.1 PG Test will be conducted within a period of two months after successful completion of trial operation.

3.2 The PG test shall be undertaken only after the resins have been subjected to at least three normal regeneration and service cycles after commissioning.

3.3 During PG Test all the alarms and inter-locks to be checked

3.4 All relevant analysis results and test certificates shall be submitted by the vendor for the exchanger bed media prior to the commencement of PG Test.

3.5 All the instruments required for conducting PG test shall be calibrated by the vendor in presence of NTPC representatives prior to the start of the PG Test by the standard methods acceptable to NTPC. Wherever this is not possible, valid calibration certificates by an approved agency shall be submitted by the vendor.

3.6 Standard analytical procedures shall be followed for the determination of various chemical parameters. Laboratory facilities as available at NTPC-LARA site may be made available, if required. If laboratory facility does not exist for any test, the supplier will arrange the same from NTPC/Govt. approved laboratories.

3.7 The influent and effluent parameters shall be analyzed every 4-hour. However, online analyzers provided shall be taken for recording every 2-hour wherever applicable.

3.8 Necessary tools and instruments required for PG Test shall be arranged by the vendor. Laboratory facilities as available at site may be made available, if required. If laboratory facility does not exist for any test, the supplier will arrange the same from NTPC/Govt. approved laboratories.

3.9 In case, during PG test if the equipment/ system has failed to meet the guarantees, the vendor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the PG Test with employer's consent.

3.10 Vendor will submit authenticated documents with signature and stamp on each page.

3.11 If start-up and condenser leak conditions do not exist during the entire PG test period, a joint protocol will be submitted for the same.

3.12 All the log-sheets and protocols of PG test shall be jointly signed by the supplier and NTPC-LARA representatives. Unsigned or not jointly signed log-sheets & protocols will not be accepted for evaluation.

3.13 PG test report of total CPU package, complete in all respects, shall only be considered for evaluation.

3.14 Pre requisites for performance test:

i) Availability of NTPC & Supplier personnel / operational staff during the test.

ii) Uninterrupted power supply within specified parameters for the duration of the Test. Power supply is required for all Analysers.

iii) Adequate and uninterrupted Condensate Water and chemical supply.

iv) Sufficient illumination to be ensured in CPU Service area and Regeneration area.

4.0 PERFORMANCE GUARANTEE TEST PROCEDURE FOR CONDENSATE POLISHING UNIT:

S.NO.	EQUIPMENT	OBJECTIVE	PROCEDURE	REMARKS
1.	Condensate polishing plant for turbo generator units-1 & 2.	To establish the followings during three consecutive Normal Service runs.	---	----
		i). For CPU PG test, two number identified resin lots shall be tested for three service run by ensuring that at least two (if CPU is 3x50%)/ three (if CPU is 4x33%) number service vessels of each unit should be covered during PG test under normal service run. ii). During PG test period, all service vessels shall be checked for their rated design flow. iii). Parallel operation of three CPU vessels at total design flow should be checked once in all three units during PG test.	Using normal regeneration level, externally regenerate the resins filled in each service vessel one by one and re-fill the service vessels with regenerated resins. Start auto service run of first vessel by controlling inlet and bypass valves. After establishing design flow through the first vessel, start auto service run of second vessel and then third vessel by adjusting the above valves and ensuring the design flow passing through all the three vessels.	i). The test will be carried out with two (if CPU is 3x50%)/ three (if CPU is 4x33%) service vessels. ii). In case total design flow is not available, two vessels at their design flow (---- m^3/h) or one vessel at its design flow (---- m^3/h) will be tested for normal service PG test run. iii). Bypass valves should be full closed during PG test. iv). The flow rates through each service vessels and total flow will be measured with the help of online flow meters after half an hour from the time the vessels are put into service. v). Flow rate will be recorded every 2-hours.
		iv). Service length of 30 days (720 hours) at design flow between	The service run will continue till the effluent parameters remains within limits as given	Total flow through each vessel will be measured using

S.NO.	EQUIPMENT	OBJECTIVE	PROCEDURE	REMARKS
		two regenerations using single regenerant quantity. the un-ammoniated resins shall not reach "ammonia break-point" in less than 30 days (720 hrs) of continuous operation while maintaining the effluent quality as specified in **Section-2.1.** Whenever specific conductivity starts increasing from 0.1 micro mhos/cm in the effluent, it is deemed that "ammonia break point" is reached.	in **Section-2.1.**; the Specific conductivity of the effluent remains less than or equal to 0.100 µS/cm at 25^0C or throughput per vessel has reached -------- m^3 whichever occurs earlier. If the inlet quality is higher than the design value as per **Section-2.1**, service cycle will be reduced based on the load and the same shall be established. The revised calculations for higher inlet load than design will be accepted after approval of NTPC-Engg (CC). There will be three normal PG test runs with an identified resin lot for a unit preceded by single regeneration Average result from three consecutive PG test runs will be considered for evaluation.	online flow integrators. Flow rate, total flow and online parameters will be recoded every 2-hours. Other chemical parameters will be tested 4-hourly in the laboratory. In case a service run is interrupted & stopped for some time and again restarted after extra rinsing, such extra rinse water volume will be added to service run output.
		vi) Pressure drop across the polisher service vessel of 2.1 kg/cm^2 in clean and 3.5 kg/cm^2 under dirty conditions of resin at design flow.	The pressure drop under clean conditions will be measured after half an hour of the vessel containing freshly regenerated resins are put into service. The pressure drop under dirty conditions will be measured at the end of service run.	The pressure drop across the resin bed will be measured using online differential pressure indicator. The pressure drop under clean conditions shall include losses due to entrance & exit nozzles, distributors, under drains, resins and the effluent resin trap and under dirty conditions shall include the pressure drop across effluent resin traps. Pressure drop will be recorded every 2-hours.
2.	Condensate polishing plant for turbogenerator units- 1, & 2.	To establish the followings during start up condition run:	--	--
		i) Useful service run of not less than 50 hours.	Freshly single regenerated resins are transferred to service vessel and the vessel is put into service.	The influent crud level during startup will be up to 1000 ppb.
		ii) Total crud		

S.NO.	EQUIPMENT	OBJECTIVE	PROCEDURE	REMARKS
		content of the effluent not more than 150 ppb.	The influent & effluent crud levels are measured every 4-hour.	The crud levels are measured gravimetrically using 0.45 micron filter paper.
3.	Condensate polishing plant for turbogenerator units- 1, & 2.	To establish the followings during condenser leak condition run:		
		i) Useful service run of not less than 50 hours. ii) Both sodium and silica contents of the effluent to be less or equal to 20 ppb. iii) All other effluent parameters as per Annexure -I.	Freshly single regenerated resins are transferred to service vessel and the vessel is put into service.	The influent TDS will be 2000 ppb in addition to the normal influent contaminants as stated in **Section-2.4.** Flow rate, total flow and online parameters will be recoded every 2-hours. Other chemical parameters will be tested 4-hourly in the laboratory.
4.	Condensate polishing plant for turbogenerator units- 1, & 2.	To establish all other guarantees/ parameters as specified in **Section 2.0** of this procedure and Scope.	--	--

5.0 **Agency should submit the detailed PG test procedure based on the above details for approval of NTPC**

PG Test Procedure for DM Plant (Ion Exchange Resin-based)

Scope: PG Test shall be conducted after successful trial run to establish:

2. Quality and quantity of water produced from different filter/exchanger beds of DM streams as per technical specification
3. Time requirement for regeneration as per technical specification
4. Chemical requirement for regeneration as per technical specification
5. Functioning of the plants in manual, semi-auto and auto modes (as specified).
6. To establish the performance under actual installed conditions with the pumps as a part of the system & when operating against the system resistance. The purpose of the test will be to confirm whether the equipment meets specifications in respect of following parameters asper the technical specification with respect to Capacity, Total dynamic head (TDH) and Power.
7. Noise , vibration levels, protection & interlock and other functional guarantees of different rotating machines and equipment

The purpose of the test will be to confirm whether the equipment meets specifications w.r.t. the guaranteed parameters. The acceptance criteria will be as per the defined technical specifications.

Test Methodology:

S.N.	Unit	Test Objective	Test Procedure	Remarks
	Activated Carbon Filters	To Check: a. The capacity of each filter. b. The effluent quality from each filter. c. Backwash & rinse time requirement of each filter d. The guarantee parameters.	a. Backwash & run each filter at the design flow rate with the corresponding D.M. stream by the mode at which the stream is running. b. Check the effluent quality of the outlet of each filter for the guaranteed parameters. c. The end of run of filter will be considered when the rated throughput is achieved or the differential pressure becomes 80% of the maximum tolerable pressure difference, whichever is earlier.	a. In case pressure difference exceeds 80% of max tolerable then the test will be repeated. Reason for high pressure difference & action taken shall be recorded in PG test report. b. The activated carbon shall work for a period of not less than 3 years without any regeneration / activation. *Along with P.G. Test evaluation report, a certificate in this respect shall be issued by the vendor.*
	DM STREAM	To Check: a. The quantity & quality of water produced from each cation, anion & MB unit. b. The time requirement for regeneration.	a. Run the units to exhaustion or to the calculated output. Single regenerate the units & consider the subsequent run at design flow as the test run for the cation, anion & MB units. b. Total backwash of counter current strong exchanger shall be done only when the DP across the strong exchanger units is more than 80% of the maximum tolerable pressure difference.	a. If there is an interruption of more than 2 hours during service run due to any reason, extra rinse water quantity is to be added in the output of respective units. Record the total time of regeneration and backwash required for ACF, Cation, Anion and MB along with chemical consumption. b. Inlet water analysis shall be determined by making arithmetic average of all two hourly readings of filtered water

				taken during the test. Based on this inlet water analysis, regeneration level employed, resin volume provided the guaranteed capacity of the stream in terms of total volume (gross output) of treated water (cu.m) between two regenerations shall be calculated before test.
		c.The chemical requirement for regeneration. d. The guarantee parameters.	c. Double regeneration is necessitated to the anion if it is subjected to alkaline brine wash or total backwash; double regeneration of cation is necessitated if it is subjected to total backwash. There after run the unit with single qty of chemicals and run the unit up to calculated throughput for P.G. Test. d. The end of cation exchanger will be considered when the calculated output has been reached or the effluent quality as per guarantee is not met from the cation or when the strong base anion exchanger of the relevant stream has reached its end point, whichever occurs earlier. e. Demonstrate total time of regeneration of cation & anion units within the guaranteed time and also demonstrate regeneration time for cation, anion and MB units within the guaranteed time. f. The end of run of anion exchanger will be considered when the calculated output has reached or the effluent quality as per guarantee is not met from the strong base anion or when the cation exchanger of the relevant stream has reached its end points, whichever occurs earlier. g. The end of run of MB exchanger will be considered when the guaranteed parameters are not met with for the effluent or when the desired output is achieved, whichever is earlier. h. All exchanger and degasser shall be checked for the guaranteed parameters. i. Before & after the test, check the resin volume in all the exchanger beds.	c. Quantity of treated water as determined by this test shall be checked against calculated quantity of treated water as in b) and must be equal to or more than the calculated amount.
	D.M Stream parallel run of all the	To Check: The functional requirement.	a. Regenerate the exhausted units. b. Run all the streams in parallel for at least 8 hours. c. Check the functional requirement	Ideally start all streams service run together to try to get 8 hours' parallel run together. Samples of water will be

	streams		including DCS.	analyzed every two hours from outlet of activated carbon filter, cation exchanger, degasser pump, anion exchanger and mixed beds exchanger.

Table A: CHEMICAL PARAMETERS (OUTPUT QUALITY)

Sample_ID	Organic Matter in ppm (as KMnO4 consumption)	Turbidity (NTU)	Sodium (as ppm CaCO3)	pH	Spec Conductivity (us/cm) at 25 deg C	Free CO2 as CO2 (ppm)	Reactive Silica as SiO2 (ppm)	Iron as Fe (ppm)	Free residual ClO2 (ppm)	Total Hardness as ppm CaCO3
ACF Outlet	*BDL	<0.5	---	---	---	---	---	---	#ND	---
Cation Outlet	---	---	Sodium leakage through cation shall not exceed 2ppm throughout the period between two regenerations.	---	---	---	---	---	---	---
Degassed Outlet	---	---	---	---	---	< /= 5.0	---	---	---	---
Anion Outlet	---	---	---	---	Not more than 10.0	---	Not to exceed 0.2	---	---	---
MB Outlet	---	---	---	6.8-7.3	Not more than 0.1	---	Not to exceed 0.01	#ND	---	#ND
Among all the parameters pH & Conductivity shall be measured by online analysers while others will be measured by mutually agreed standard test procedures.										

*BDL: Below Detectable Limit, #ND: Not Detected

CYCLE OF STREAM OPERATION:

Three regeneration and service cycle (One in manual and two in auto mode) shall be carried out for each stream. And one regeneration & service cycle shall be carried out for MB exchanger. The average value for each DM stream shall be taken for evaluation.

OTHER GUARANTEES & NORMS:

i. All the instruments and interlocks provided with requisite controls and alarms shall be checked during period of test record.

ii. List of instruments shall be provided by the vendor. All the instruments required for the P.G test should be calibrated by the contractor in presence of NTPC representative prior to the start of the Test. Whenever this is not possible, valid calibration certificate by an independent NABL-accredited calibration agency shall be submitted by the contractor.

iii. Before starting PG test, output calculation based on present feed water analysis will be submitted by vendor.

iv. Before the start of PG test, resin and ACF quantity is to be recorded for each vessel.

v. Agency should submit complete resin literature details alongwith output calculation for verification by NTPC.

vi. If any of the guaranteed parameters cannot be tested at site NTPC laboratory, the agency shall arrange for the testing of the same at NTPC approved laboratory or NABL – accredited laboratory. After the completion of the above, the result copy to be duly signed and submitted.

Note: Agency should submit the detailed PG test procedure based on the above details for approval of NTPC.

PG TEST PROCEDURE FOR DM PLANT (UF-RO-BASED)

1.0 SCOPE: PG Test shall be conducted after successful completion of trial run to establish the various guarantee parameters:

8. Effluent quality and capacity of water each of ultrafiltration, reverse osmosis skid, degasser and mixed bed exchangers.
9. Noise and vibration level of all rotary equipments.
10. Current, voltage, motor input power, frequency, speed, bearing/motor winding temperature, vibration and noise-level of pumps, blowers and their drives and parallel operation of pumps & blowers.
11. Total power consumption of the pumps and power consumption of individual pumps as defined in technical specifications shall be taken for evaluation.

2.0 GENERAL REQUIREMENTS:

a. Responsibility of test conductance: Agency
b. Water analysis standard procedures to be adopted during PG Test are as follows:
   i. ASTM D4195: Standard Guide for Water Analysis for Reverse Osmosis Applications" or equivalent methods of the AWWA/APHA Standard Methods of USEPA.
   ii. Standard procedures related to SWRO (Surface water RO) system include D 3739, D4189, D4194, D4195, D 4516, D4582, D 4692, D 4993.
c. All necessary tools & tackles, equipment, any additional equipments viz. piping, valves strainers etc required for PGT shall be arranged by vendor. Laboratory facilities at site shall be made available for analysis purpose. In absence of proper lab facility, same shall be arranged by the vendor/sample to be got tested at external NABL –accredited labs.
d. Calibration of instruments required for conducting the PGT shall be done from external Govt approved/ NABL-accredited laboratories. Calibration certificate validity should be till the end of PG Test.
e. Quality of resin in each MB vessel along with top-up quantity, if any, is to be recorded before the start of PGT.

3.0 TEST METHODOLOGY:

a) PGT shall be conducted for a minimum period of 72 hours for each UF and RO Train/Skid/Stream. The test shall be carried out for each train/skid in sequence.
b) For each MB, three cycle (regeneration and service) shall be carried out. The average value for each stream shall be taken for evaluation.
c) Inlet water analysis shall be determined by making arithmetic average of all readings of filtered water taken during the test.
d) Based on the inlet water analysis (at MB inlet), regeneration level employed, resin volume provided, & characteristic curves employed, the guaranteed capacity of the stream in terms of total volume of treated water (cum) between regenerations shall be calculated and submitted by the agency. Resin volume for taking output should include buffer layer provided. The calculation shall be submitted to NTPC for approval.
e) For Mixed Bed, the guaranteed output shall be as specified.
f) DM stream shall be operated in all the modes supplied like auto/manual etc
g) Parallel run of all the streams shall be carried out for a period of at least eight hours to check the functional requirement.
h) Samples of water shall be withdrawn every two hours from the outlet of UF/RO/DG/MB and analysed at site laboratory/ Govt-approved laboratories/ NABL-accredited laboratories.
i) Power consumption calculated for specified drives shall be summed up to arrive at total power consumption.
j) Total power consumption of pumps as well as individual power consumption should not exceed as defined in technical specifications.

Note:

i. UF-CIP/ RO-CIP procedures and recipe are to be vetted by OEM of UF/RO and to be provided before conductance of PGT.
ii. Agency has to supply the O&M manual of UF-RO-MB plant before PGT conductance.

4.0 PG TEST PROCEDURE:

S.N.	Unit	Test Objective	Test Procedure	Remarks
1a	Ultrafiltration	Capacity with backwash and air-scouring (if applicable)	System to be run for 72 hours.	Test duration: 72 hours for each Train/Skid/Stream.
1b		Effluent Quality	UF to be taken into service after every backwashing/ cleaning. Effluent to be sampled and analysed.	Inlet & outlet flow, pH, turbidity, SDI, $KMnO_4$ number and residual Chlorine/ ClO_2 to be measured at every 2 hours.
1c		Backwash Water Requirement	Backwashing to be carried out.	Water consumption to be recorded in each successive backwash/cleaning.
2a	Feed Water inlet at RO skid	Influent flow	Adjust the flow of each RO skid as per defined technical specifications.	Test duration: 72 hours for each Train/Skid/Stream.
2b		Influent quality	RO effluent to be sampled and analysed.	Feed flow, pressure, Conductivity, pH, TDS, Res chlorine/ ClO_2, SDI, ORP, Boron (if applicable) to be measured every 2 hours.
3a	RO Permeate	Effluent Capacity	Adjust the permeate and reject flow in such a way that the RO recovery meets the required technical specifications.	Test duration: 72 hours for each Train/Skid/Stream.
3b		Effluent Quality	System to be run for 72 hours.	Permeate Flow, Pressure, Conductivity, pH, TDS to be measured every 2 hours.
4	At Degasser inlet and outlet	Effluent Quality	System to be run for 72 hours.	Flow, pH, CO_2 & conductivity to be measured every 2 hours.
5	At MB inlet & outlet	To check: a) The quality & quantity of water produced from each MB unit. b) The requirement for regeneration. c) The chemical requirement for regeneration.	a) Regenerate the MB units with guaranteed quantity of chemicals. b) Run the units upto calculated output. c) The end of MB exchange shall be considered when the guaranteed parameters are not achieved for the effluent or when the desired output is achieved, whichever is earlier. d) Time required for regeneration. e) Double regeneration, if necessitated to the MB after seven (or as specified elsewhere)	a) Three Service cycles for each MB shall be conducted. b) Total time of MB regeneration along with chemical consumption to be recorded. c) Guaranteed net output from each MB unit between two successive regenerations (using guaranteed chemical quantities) shall be as defined in technical specifications. Quality of MB outlet shall be as per guaranteed parameters.

			regenerations. Use double qty of chemicals for double generation.	
6	Mixed Bed Ion Exchange Units	Parallel run of DM Streams to check the functional requirement	a) Regeneration of exhausted MB units. b) Run MB streams in parallel for eight hours. c) Check all programs of service and regeneration of MB.	Quality of MB outlet shall be as per guaranteed parameters. Ideally start all the stream service run together to try to get 8 hours parallel run together.

5.0 GUARANTEED PARAMETERS (AS SPECIFIED IN TECHNICAL SPECIFICATIONS)

S.N.	Unit	Test Objective	Parameters	Remarks
1	UF	Effluent Capacity	Net permeate flow from each UF skid/Train	
		Effluent Quality	SDI, Turbidity, BOD, Organic Matter	
		Life of UF membrane	5 years (minimum) or as specified in technical specifications	
2	RO feed	Effluent Quality	SDI, turbidity, pH, Res ClO2	
3	RO permeate	Effluent Capacity	Net permeate flow from each RO skid	
		Effluent Quality	TDS	
		Life of RO membrane	3 years (minimum) or as specified in technical specifications	
4	Degasser Tower	Effluent Capacity	As per technical specifications	
		Effluent Quality	CO2 at degasser outlet	
5	MB unit	Effluent Capacity	As per technical specifications	
		Effluent Quality	Reactive silica < 0.01 ppm as SiO2 Iron as Fe- Not Detectable as per ASTM D 1068. Total Hardness- BDL pH- 6.8-7.3 Conductivity- Max 0.1 us/cm	
		Regeneration time	As per technical specifications	

Note:

i. Agency has to submit the detailed PGT procedure as per the above details for approval of NTPC.

ii. List of instruments has to be provided by agency during PGT procedure submission for approval purpose.

Standard PG Test Procedure:

Pre-Treatment Plant

Scope: PG Test shall be conducted after successful trial run to establish the various guarantee parameters as defined in the technical specifications.

(a) Guaranteed effluent quality and capacity for each of Clarifier, Gravity Filter, Tube Settler and Coal Slurry Settling Pond.

(b) Sample collection and analysis:

Table1:

S.N.	Sample_ID	Chemical parameters	Frequency of sampling
1	Raw Water	All parameters given in feed analysis	Once/day
2	Clarifier Outlet	Flow, Organic matter, Iron content, Turbidity	Two-hourly
3	Gravity Filter Outlet	Flow, Turbidity	Two-hourly
4	Tube Settler Inlet & Outlet	Flow, Turbidity, Oil & Grease	Two-hourly
5	CSSP outlet	TSS, Particle size	Two-hourly
Note: Joint sampling to be done during PGT.			

(c) Noise and vibration levels of all rotary equipments.

(d) Current, voltage, motor input power, frequency, speed, bearing/motor winding temperature, vibration and noise level of pumps, blowers and their drives and parallel operation of pumps and blowers, if applicable are to be demonstrated.

(e) Capacity, head and power consumption of specified pumps.

General Requirements:

(a) Responsibility of conducting the test: Agency

(b) Standard analytical procedures to be followed for chemical parameter determination.

(c) All necessary tools & tackles, equipment, any additional equipments viz. piping, valves strainers etc required for PGT shall be arranged by vendor. Laboratory facilities at site shall be made available for analysis purpose. In absence of proper lab facility, same shall be arranged by the vendor/sample to be got tested at external NABL labs.

Test Methodology:

(a) After raw water supply is established in clarifier, flow to be adjusted as desired, amount of treatment chemicals is to be assessed by jar test at site.

(b) PGT shall be carried out separately for clarifier, gravity filter, tube settler, coal slurry settling pond of rated flow for a time period as defined in technical specifications.

(c) The guaranteed parameters of respective systems shall be demonstrated during performance guarantee test as per approved test procedure, test procedure is to be submitted by agency.

PT-CW Clarifier , PT-DM Clarifier & Tube Settlers

Test Objective	Test Procedure	Remarks
Effluent Capacity	Flow is to be adjusted so that the effluent quantity from clarifiers/Tube Settler is as defined in technical specifications.	i.Duration of each test shall be 8 hours and one run in one day shall be conducted. ii.Three tests shall be run for each clarifier/Tube settler and average value of three test runs shall be considered for approval.
Effluent Quality	Chemicals shall be dosed based on laboratory Jar Test results for the water available at the time of PGT.	
	20% overloading test of each clarifier is to be done exactly in line with 100% flow test procedure for 8 hours.	

PT-Potable Gravity Filter & PT-DM Gravity Filter

Test Objective	Test Procedure	Remarks
Effluent Capacity	Flow is to be adjusted so that the effluent quantity from clarifier is as defined in technical specifications.	i.Duration of each test of filter shall be 24 hours. ii.Three tests shall be run for each gravity filter and average value of three test runs shall be considered for approval.
Effluent Quality	Effluent from filter is to be sampled and analysed.	
	Backwash water requirement not to exceed 2% of water treated between two successive backwashes.	

Test Summary (Table 2):

S.N.	Unit	Test Objective	Parameters	Remarks
1	PT-CW clarifier, PT-DM Clarifier	Effluent Capacity	Flow	By Flow Transmitter
		Effluent Quality	Turbidity & Iron	By Offline testing
			Organic matter	KMnO4 Method
2	PT-Potable Gravity Filter, PT-DM Gravity Filter	Effluent Capacity	Flow	By Flow Transmitter
		Effluent Quality	Turbidity	By Offline testing
3	Tube Settler	Effluent Capacity	Flow	By Flow Transmitter
		Effluent Quality	Turbidity, Oil & Grease	By Offline testing
4	CSSP	Effluent Quality	Effluent TSS at the outlet of each CSSP during storm water flow condition as defined in technical specifications.	By Flow transmitter and offline testing of TSS

Note:

i. List of instruments is to be provided by vendor.
ii. Chemical consumption: As per design calculations submitted by agency.
iii. Agency should submit the detailed PG test procedure based on the above details for approval of NTPC.

SPECIAL NOTE:

PG test procedure for CHP Run off Water Treatment shall be as mentioned in PT Plant PG Test requirement indicated above as applicable,

ANNEXURE -IV

DRAWING/ DOCUMENTS REQUIREMENT & DISTRIBUTION SCHEDULE

After award of LOI, The drawing documents listed in MDL are minimum drawing/documents, which shall be submitted by the bidder for BHEL and Customer approval. However, any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/ documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

Every revised submission incorporating BHEL/Customer comments shall be resubmitted within 7 day by bidder.

BHEL shall provide observation / approval within 21 days from the date of document submission by bidder. Bidder to further note that the submitted drawings/ revised drawing, should be complete in all respects. Any incomplete drawing submitted shall be treated as non-submission and delay in approval/ comments shall be attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL's/ Customer's office for across the table discussions/ finalizations/ submissions of drawings.

- (a) List and schedule of drawings/documents to be submitted after award of contract shall be as per MDL.

- Bidder to note that drawings/documents submission shall be through web-based Document Management System. Bidder would be provided access to the DMS for drawings/documents approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
  - Internet explorer version – Minimum Internet Explorer 7
  - Internet speed – 2 mbps (Minimum preferred)
  - Pop ups from our external DMS IP (124.124.36.198) should not be blocked
  - Vendor's internal proxy setting should not block DMS application's link
    - (http://124.124.36.198/wrenchwebaccess/login.aspx)
  - DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
  - For quick access bidder may refer the link http://bhelpem.com/DMSManuals/DMSManuals.html

- Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/Customer consultant/BHEL-site/BHEL-PEM. The exact number of hard copies/CD ROMs of these documents to be submitted shall be notified to the bidder at the time of detailed engineering and bidder shall submit the same without any commercial/ delivery implications to BHEL/Customer.

- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.

- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.

- Editable copy of all the drawings and documents shall be provided.

- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.

- Vendor to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.

- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.

- Bidder to also furnish the auto cad copy/ MS-Excel/ MS-word (as applicable) of the following documents after award of contract. However, any other auto cad copy/ MS-Excel/ MS-word of any other document as per the insistence of BHEL and customer will also be submitted by the bidder without any delivery and commercial implication to BHEL and customer.

  - P&IDs.
  - Equipment layouts.
  - Equipment Cable tray layouts.
  - Civil assignment drawings.
  - Piping lay out drawings.

- The engineering for packages will essentially be done using Intelligent 3D modelling. Preparation of 3 D modelling drawing shall be in bidder's scope for bidder's supplied and design engineered items/ structures for turn key water treatment packages. AVEVA E3D is being used at BHEL's end for BHEL scope items hence bidder has to use same software for preparation of 3D drawings. Bidder has to submit 3D drawings in editable format for integration with BHEL's 3D drawings. Further detailing shall be shared by BHEL during detailed engineering.

MASTER DRAWING LIST

MASTER DRAWING LIST OF CHLORINE DI OXIDE DOSING SYSTEM

SL. NO.	BHEL DRG NO	DRG TITLE	SCHEDULE OF SUBMISSION FROM LOI IN WEEKS	DRG/ DOC SIZE
1	PE-V0-512-154-13000-W103	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM INCLUDING JB LOCATION OF INSIDE AND OUTSIDE CHLORINE DIOXIDE DOSING SYSTEM	12	A1
2	PE-V0-512-154-13000-W104	EARTHING LAYOUT OF INSIDE AND OUTSIDE CHLORINE DIOXIDE DOSING SYSTEM	12	A1
3	PE-V0-512-154-13000-W101	ELECTRICAL LOAD LIST	10	A4
4	PE-V0-512-154-13000-W102	DATASHEET OF MOTORS	10	A4
5	PE-V0-512-154-13000-W212	INSTRUMENT INSTALLATION DRAWINGS/ HOOK UP DIAGRAM FOR INSTRUMENTS	10	A4
6	PE-V0-512-154-13000-W201	LIST OF DRIVES, JB GROUPING AND I/O LIST	10	A4
7	PE-V0-512-154-13000-W205	INSTRUMENT SCHEDULE	10	A4
8	PE-V0-512-154-13000-W211	CABLE SCHEDULE AND INTERCONNECTION DIAGRAM	10	A4
9	PE-V0-512-154-13000-W206	DATASHEET OF ANALYSERS	12	A4
10	PE-V0-512-154-13000-W207	DATASHEET OF TRANSMITTERS	12	A4
11	PE-V0-512-154-13000-W208	DATASHEET OF LOCAL INSTRUMENTS	12	A4
12	PE-V0-512-154-13000-W209	DATASHEET OF SOLENOID VALVE	12	A4
13	PE-V0-512-154-13000-W210	DATA SHEET AND GA FOR JUNCTION BOXES	12	A4
14	PE-V0-512-154-13000-W008	GA DRAWING OF ATMOSPHERIC TANKS	10	A3
15	PE-V0-512-154-13000-W020	CIVIL INPUT DRAWING OF CHLORINE DIOXIDE DOSING SYSTEM	10	A1
16	PE-V0-512-154-13000-W002	LAYOUT OF CHLORINE DIOXIDE DOSING SYSTEM *	8	A1
17	PE-V0-512-154-13000-W021	PIPING LAYOUT INSIDE CHLORINE DIOXIDE DOSING SYSTEM AREA ALONG WITH DETAILS OF SUPPORTS	14	A1
18	PE-V0-512-154-13000-W022	YARD PIPING LAYOUT ALONG WITH DETAILS OF SUPPORTS	16	A0
19	PE-V0-512-154-13000-W017	VALVE SCHEDULE	10	A4
20	PE-V0-512-154-13000-W018	PIPING SCHEDULE	10	A4
21	PE-V0-512-154-13000-W019	PAINTING SCHEDULE	10	A4
22	PE-V0-512-154-13000-W001	P&ID FOR CHLORINE DIOXIDE DOSING SYSTEM *	6	A1
23	PE-V0-512-154-13000-W003	PROCESS DESIGN & SIZING CALCULATIONS, PRESSURE DROP CALCULATIONS OF CHLORINE DIOXIDE DOSING SYSTEM *	6	A4
24	PE-V0-512-154-13000-W005	CONTROL WRITE UP CHLORINE DIOXIDE DOSING SYSTEM *	6	A4
25	PE-V0-512-154-13000-W023	PG test procedure for CHLORINE DIOXIDE DOSING SYSTEM	18	A4
26	PE-V0-512-154-13000-W025	O& M MANUAL	20	A4
27	PE-V0-512-154-13000-W006	TECHNICAL DATA SHEET AND GA DRG OF HORIZONTAL CENTRIFUGAL PUMPS	10	A4
28	PE-V0-512-154-13000-W007	TECHNICAL DATA SHEET AND GA DRG FOR METERING PUMPS	10	A4

29	PE-V0-512-154-13000-W009	DATASHEET AND GA DRAWING OF CHLORINE DIOXIDE GENERATORS	10	A4
30	PE-V0-512-154-13000-W010	DATASHEET AND GA DRG OF SAFETY ITEMS	10	A4
31	PE-V0-512-154-13000-W011	DATASHEET AND GA DRG OF BUTTERFLY VALVE MANUAL AND PNEUMATIC	10	A4
32	PE-V0-512-154-13000-W012	DATASHEET AND GA DRG OF DIAPHRAGM VALVE MANUAL AND PNEUMATIC	10	A4
33	PE-V0-512-154-13000-W013	DATASHEET AND GA DRG OF GLOBE & BALL VALVE	10	A4
34	PE-V0-512-154-13000-W014	DATASHEET AND GA DRG OF PRV, SRV & NEDDLE VALVE	10	A4
35	PE-V0-512-154-13000-W015	DATASHEET AND GA DRG OF GATE VALVE	10	A4
36	PE-V0-512-154-13000-W016	DATASHEET AND GA DRG OF NRV	10	A4
37	PE-V0-512-154-13000-W004	SUB VENDOR LIST AND INSPECTION CRITERIA FOR WATER TREATMENT PACKAGES *	8	A4
38	PE-V0-512-154-13000-W301	QAP FOR HORIZONTAL CENTRIFUGAL PUMP	10	A4
39	PE-V0-512-154-13000-W302	QAP FOR METERING PUMP	10	A4
40	PE-V0-512-154-13000-W303	QAP FOR ATMOSPHERIC TANK	10	A4
41	PE-V0-512-154-13000-W304	QAP FOR BUTTERFLY VALVE MANUAL AND PNEUMATIC	10	A4
42	PE-V0-512-154-13000-W305	QAP FOR DIAPHRAGM VALVE MANUAL AND PNEUMATIC	10	A4
43	PE-V0-512-154-13000-W306	QAP FOR GLOBE VALVE	10	A4
44	PE-V0-512-154-13000-W307	QAP FOR BALL VALVE	10	A4
45	PE-V0-512-154-13000-W308	QAP FOR PRV, SRV & NEDDLE VALVE	10	A4
46	PE-V0-512-154-13000-W309	QAP FOR GATE VALVE	10	A4
47	PE-V0-512-154-13000-W310	QAP FOR NRV	10	A4
48	PE-V0-512-154-13000-W311	QAP FOR MS/CS PIPES RUBBER LINED	10	A4
49	PE-V0-512-154-13000-W312	QAP FOR CPVC PIPES	10	A4
50	PE-V0-512-154-13000-W316	QAP / ICL OF CHLORINE DIOXIDE DOSING SYSTEM (FOR BALANCE OF ITEMS)	10	A4

MASTER DRAWING LIST OF CHP RUN OFF WATER TREATMENT PLANT

SL. NO.	BHEL DRG NO	DRG TITLE	SCHEDULE OF SUBMISSION FROM LOI IN WEEKS	DRG/ DOC SIZE
1	PE-V0-512-157-W001*	P & I DIAGRAM FOR CHP RUN-OFF WATER TREATMENT PLANT*	6	A1
2	PE-V0-512-157-W002*	PROCESS SIZING & HYDRAULIC CALCULATION FOR CHP RUN-OFF WATER TREATMENT PLANT*	6	A4
3	PE-V0-512-157-W003*	COMPOSITE PLANT LAYOUT FOR CHP RUN-OFF WATER TREATMENT PLANT*	8	A0
4	PE-V0-512-157-W004*	SYSTEM DESCRIPTION & CONTROL WRITE UP FOR CHP RUN-OFF WATER TREATMENT PLANT*	6	A4
5	PE-V0-512-157-W005*	BASIC CIVIL DESIGN CRITERIA FOR CHP RUN-OFF WATER TREATMENT PLANT*	6	A4
6	PE-V0-512-157-W006	G.A OF INLET CHAMBER (PARSHALL FLUME, STILLING CHAMBER & INLET WELL.) FOR CHP RUN-OFF WATER TREATMENT PLANT*	10	A1
7	PE-V0-512-157-W007	CIVIL GA, FOUNDATION, SUPER STRUCTURE AND RCC DETAILS OF STILLING CHAMBER, PARSHALL FLUME & INLET WELL FOR CHP RUN-	12	A1

		OFF WATER TREATMENT PLANT*		
8	PE-V0-512-157-W008	CIVIL DESIGN CALCULATION OF STILLING CHAMBER, PARSHALL FLUME & INLET WELL.FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A1
9	PE-V0-512-157-W009	G.A AND DATASHEET OF REACTOR CLARIFIERS FOR CHP RUN-OFF WATER TREATMENT PLANT*	10	A1
10	PE-V0-512-157-W010	CIVIL GA OF REACTOR CLARIFIER FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A1
11	PE-V0-512-157-W011	RCC DETAILS OF REACTOR CLARIFIER FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A1
12	PE-V0-512-157-W012	CIVIL DESIGN CALCULATION OF REACTOR CLARIFIER FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A1
13	PE-V0-512-157-W013	G.A OF SLUDGE SUMP FOR CHP RUN-OFF WATER TREATMENT PLANT*	10	A1
14	PE-V0-512-157-W014	CIVIL GA OF SLUDGE SUMP FOR CHP RUN-OFF WATER TREATMENT PLANT.	12	A1
15	PE-V0-512-157-W015	RCC DETAIL OF SLUDGE SUMP FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A1
16	PE-V0-512-157-W016	CIVIL DESIGN CALCULATION OF SLUDGE SUMP FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A1
17	PE-V0-512-157-W017	G.A OF CHEMICAL STORAGE SHED INCLUDING OVERHEAD TANK FOR CHP RUN-OFF WATER TREATMENT PLANT*	10	A1
18	PE-V0-512-157-W018	CIVIL GA & R/F DETAILS OF FOUNDATION, COLUMNS AND PLINTH BEAMS OF CHEMICAL SHED FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A1
19	PE-V0-512-157-W019	ARCHITECTURAL DETAILS, GROUND FLOOR PLAN, SECTION & ELEVATION, TERRACE PLAN ETC. OF CHEMICAL SHED FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A1
20	PE-V0-512-157-W020	CIVIL DESIGN CALCULATION OF CHEMICAL SHED FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A4
21	PE-V0-512-157-W021	DRIVE LIST (DRIVES CONTROLLED FROM DDCMIS) FOR CHP RUN-OFF WATER TREATMENT PLANT	10	A4
22	PE-V0-512-157-W022	I/O LIST FOR CHP RUN-OFF WATER TREATMENT PLANT	10	A4
23	PE-V0-512-157-W023	INSTRUMENT SCHEDULE FOR CHP RUN-OFF WATER TREATMENT PLANT	12	A4
24	PE-V0-512-157-W024	PAINTING SCHEDULE FOR CHP RUN-OFF WATER TREATMENT PLANT.	12	A4
25	PE-V0-512-157-W025	PIPE SCHEDULE FOR CHP RUN-OFF WATER TREATMENT PLANT.	10	A4
26	PE-V0-512-157-W026	GENERAL ARRANGEMENT & CIVIL BLOCK OUT DETAILS OF SLUICE GATE (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
27	PE-V0-512-157-W027	DATASHEET FOR PLATFORM TYPE WEIGHING SCALE. (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
28	PE-V0-512-157-W028	DATASHEET AND G.A OF AIR BLOWER (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
29	PE-V0-512-157-W029	DATASHEET & WIRING DIAGRAM OF ELECTRICAL ACTUATOR (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
30	PE-V0-512-157-W030	INSTRUMENTS HOOK UP DRAWINGS FOR CHP RUN-OFF WATER TREATMENT PLANT	10	A4
31	PE-V0-512-157-W031	G.A AND DATASHEET OF TANK AGITATOR ASSEMBLY (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
32	PE-V0-512-157-W032	GA AND DATASHEET OF HORIZONTAL CENTRIFUGAL PUMPS WITH MOTOR (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
33	PE-V0-512-157-W033	DATASHEET FOR SAFETY SHOWER AND	10	A4

		EMERGENCY KIT B (CHP RUN-OFF WATER TREATMENT PLANT)		
34	PE-V0-512-157-W034	LCP OF REACTOR CLARIFIERS FOR CHP RUN-OFF WATER TREATMENT PLANT.	10	A4
35	PE-V0-512-157-W035	INTERCONNECTION DIAGRAM AND CABLE SCHEDULE FOR CHP RUN-OFF WATER TREATMENT PLANT AREA	10	A4
36	PE-V0-512-157-W036	GA DRAWING & CALCULATION OF ELECTRICAL HOIST (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
37	PE-V0-512-157-W037	PIPING LAYOUT OF CHP RUN OFF WATER TREATMENT PLANT	10	
38	PE-V0-512-157-W038	OPERATION & MAINTENANCE MANUAL (CHP RUN OFF WATER SYSTEM)	10	A4
39	PE-V0-512-157-W039	DATA SHEET FOR LOCAL GAUGES (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
40	PE-V0-512-157-W040	DATA SHEET FOR FLOW ELEMENT ALONG WITH ORIFICE CALC. (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
41	PE-V0-512-157-W041	TECHNICAL DATA SHEET FOR FLOW TRANSMITTER (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
42	PE-V0-512-157-W042	DATA SHEET FOR JUNCTION BOX (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
43	PE-V0-512-157-W043	DATA SHEET FOR PRESSURE TRANSMITTER (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
44	PE-V0-512-157-W044	DATA SHEET FOR LEVEL TRANSMITTER (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
45	PE-V0-512-157-W045	CABLE TRAY LAYOUT OF CHP RUN-OFF WATER TREATMENT PLANT	10	A1
46	PE-V0-512-157-W046	PG TEST PROCEDURE FOR CHP RUN-OFF WATER TREATMENT PLANT	20	A4
47	PE-V0-512-157-W047	CONTROL LOGIC SCHEMES OF CHP RUN-OFF WATER TREATMENT PLANT	12	A4
48	PE-V0-512-157-W048	GA AND DATASHEET OF VERTICAL CENTRIFUGAL PUMPS WITH MOTOR (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
49	PE-V0-512-157-W049	GA AND DATASHEET OF SCREW PUMPS WITH MOTOR (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
50	PE-V0-512-157-W050	GA, CROSS SECTION, PERFORMANCE CURVE AND DATASHEET OF DOSING PUMPS WITH MOTOR FOR CHP RUN-OFF WATER TREATMENT PLANT	10	A4
51	PE-V0-512-157-W051	VALVE SCHEDULE OF CHP RUN-OFF WATER TREATMENT PLANT	12	A4
52	PE-V0-512-157-W052	DATASHEET AND GA DRAWING OF DIAPHRAGM VALVES FOR CHP RUN-OFF WATER TREATMENT PLANT	10	A4
53	PE-V0-512-157-W053	DATASHEET AND GA DRAWING OF BUTTERFLY VALVES FOR CHP RUN-OFF WATER TREATMENT PLANT	10	A4
54	PE-V0-512-157-W054	DATASHEET AND GA DRAWING OF NRV/CHECK VALVES FOR CHP RUN-OFF WATER TREATMENT PLANT	10	A4
55	PE-V0-512-157-W055	DATASHEET AND GA DRAWING OF GATE VALVES FOR CHP RUN-OFF WATER TREATMENT PLANT	10	A4
56	PE-V0-512-157-W056	DATASHEET AND GA DRAWING OF PLUG VALVES FOR CHP RUN-OFF WATER TREATMENT PLANT	10	A4
57	PE-V0-512-157-W057	CABLE SCHEDULE OF CHP RUN-OFF WATER TREATMENT PLANT	10	A4
58	PE-V0-512-157-W058	GA & DATA SHEET OF FILTER PRESS (CHP RUN-OFF WATER TREATMENT PLANT)	10	A4
59	PE-V0-512-157-W059	G.A OF FILTER PRESS PLATFORM FOR CHP	10	A4

		RUN-OFF WATER TREATMENT PLANT.		
60	PE-V0-512-157-W060	CIVIL GA, FOUNDATION, SUPER STRUCTURE AND RCC DETAILS OF FILTER PRESS PLATFORM FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A1
61	PE-V0-512-157-W061	CIVIL DESIGN CALCULATION OF FILTER PRESS PLATFORM FOR CHP RUN-OFF WATER TREATMENT PLANT*	12	A4
62	PE-V0-512-157-W062	MQP FOR SLUICE GATE	10	A4
63	PE-V0-512-157-W063	MQP FOR BUTTERFLY VALVES	10	A4
64	PE-V0-512-157-W064	MQP FOR DIAPHRAGM VALVE	10	A4
65	PE-V0-512-157-W065	MQP FOR AIR BLOWER (LOBE TYPE)	10	A4
66	PE-V0-512-157-W066	MQP FOR MS PIPES	10	A4
67	PE-V0-512-157-W067	MQP FOR METERING PUMP (DIAPHRAGM TYPE)	10	A4
68	PE-V0-512-157-W068	MQP FOR ELECTRICAL ACTUATOR	10	A4
69	PE-V0-512-157-W069	MQP FOR CENTRIFUGAL PUMPS (HORIZONTAL & VERTICAL)	10	A4
70	PE-V0-512-157-W070	MQP FOR VERTICAL WET PIT TURBINE PUMP	10	A4
71	PE-V0-512-157-W071	MQP FOR REATOR CLARIFIER	10	A4
72	PE-V0-512-157-W072	TYPE TEST REPORT OF FLOW ELEMENT (CALIBRATION)	10	A4
73	PE-V0-512-157-W073	LIST OF ALARM	10	A4
74	PE-V0-512-157-W074	MQP FOR GATE/ GLOBE/ CHECK VALVES	10	A4
75	PE-V0-512-157-W075	MQP FOR NRV FLAP TYPE	10	A4
76	PE-V0-512-157-W076	MQP FOR CI/ DI PIPES & FITTINGS	10	A4
77	PE-V0-512-157-W077	MQP FOR PRESSURE VESSEL/ ATMOSPHERIC STORAGE TANKS	10	A4
78	PE-V0-512-157-W078	ELECTRICAL LOAD LIST	10	A4
79	PE-V0-512-157-W079	TYPE TEST REPORT OF ELECTRONIC TRANSMITTER	10	A4
80	PE-V0-512-157-W080	TYPE TEST REPORT OF JUNCTION BOX (DEGREE OF PROTECTION)	10	A4
83	PE-V0-512-157-W083	INSPECTION CHECK LIST / MANUFACTURING QUALITY PLAN OF FILTER PRESS	10	A4
86	PE-V0-512-157-W086	G.A OF DISTRIBUTION CHAMBER & PUMP HOUSE*	10	A1
87	PE-V0-512-157-W087	CIVIL GA OF DISTRIBUTION CHAMBER & PUMP HOUSE*	12	A1
88	PE-V0-512-157-W088	RCC DETAIL OF DISTRIBUTION CHAMBER & PUMP HOUSE*	12	A1
89	PE-V0-512-157-W089	CIVIL DESIGN CALCULATION OF DISTRIBUTION CHAMBER & PUMP HOUSE*	12	A1

MASTER DRAWING LIST OF CW TREATMENT PLANT

SL. NO.	BHEL DRG NO	DRG TITLE	SCHEDULE OF SUBMISSION FROM LOI IN WEEKS	DRG/ DOC SIZE
1.	PE-V0-512-156-W008	CABLE TRAY ROUTING DRG SHOWING INSERTS, TRENCHES, TRESTLE, SLIT ETC. DETAILS FOR CW PLANT/ STRUCTURES FOR OUTSIDE AREA.	12	A1
2.	PE-V0-512-156-W015	LOAD LIST OF CWT PLANT	10	A4
3.	PE-V0-512-156-W016	DATA SHEET OF MOTOR FOR CWT PLANT	10	A4
4.	PE-V0-512-156-W031	FRP TYPE JUNCTION BOX	10	A4
5.	PE-V0-512-156-W004	DRIVE LIST & I/O LIST (FOR DDCMIS) FOR CWT Plant	10	A4
6.	PE-V0-512-156-W005	INSTRUMENT SCHEDULE FOR CWT PLANT	10	A4
7.	PE-V0-512-156-W028	CABLE SCHEDULE (C&I) FOR CWT PLANT	10	A4
8.	PE-V0-512-156-W014	CABLE INTERCONNECTION (C&I) FOR CWT PLANT	10	A4

9.	PE-V0-512-156-W032	LOCAL POWER DISTRIBUTION DRAWING	12	A4
10.	PE-V0-512-156-W009	DATA SHEET FOR PG & DPG AND PT FOR CWT PLANT	12	A4
11.	PE-V0-512-156-W010	DATA SHEET FOR ULTRASONIC TYPE LEVEL TRANSMITTERS FOR CWT PLANT	12	A4
12.	PE-V0-512-156-W011	DATA SHEET FOR PH ANALYSER FOR CWT PLANT	12	A4
13.	PE-V0-512-156-W035	DATA SHEET FOR LEVEL GAUGE	12	A4
14.	PE-V0-512-156-W036	DATA SHEET FOR CONDUCTIVITY METER	10	A4
15.	PE-V0-512-156-W018	GA, CROSS SECTION, PERFORMANCE CURVE AND DATASHEET OF PUMP	10	A4
16.	PE-V0-512-156-W023	GA OF ATMOSPHERIC TANK FOR CWTP	8	A3
17.	PE-V0-512-156-W030	HOOK UP DRAWINGS FOR CWT PLANT	14	A4
18.	PE-V0-512-156-W034	GA FOR SKID AND FOUNDATION DETAILS	12	A3
19.	PE-V0-512-156-W007*	EQUIPMENT LAYOUT- CWT PLANT*	6	A1
20.	PE-V0-512-156-W025	PIPING LAYOUT DRG- CWT AREA	10	A1
21.	PE-V0-512-156-W006	PAINTING SCHEDULE FOR CWTP	10	A4
22.	PE-V0-512-156-W012	VALVE SCHEDULE FOR CWT PLANT	8	A4
23.	PE-V0-512-156-W001*	P&I DIAGRAM (CWT PLANT) *	4	A1
24.	PE-V0-512-156-W002*	PROCESS DESIGN & EQUIPMENT SIZING CALCULATION (CWT PLANT) *	4	A4
25.	PE-V0-512-156-W029*	CONTROL WRITE UP*	6	A4
26.	PE-V0-512-156-W033	PG TEST PROCEDURE	16	A4
27.	PE-V0-512-156-W027	O&M MANUAL (CWT PLANT)	16	A4
28.	PE-V0-512-156-W013	DATA SHEET AND GA FOR VALVES FOR CWTP	10	A4
29.	PE-V0-512-156-W019	DATA SHEET FOR BIO FOULING MONITOR	10	A4
30.	PE-V0-512-156-W020	DATA SHEET OF INSTANT CORROSION RATE MONITOR	10	A4
31.	PE-V0-512-156-W021	DATA SHEET OF SCALE MONITOR	10	A4
32.	PE-V0-512-156-W022	DATA SHEET OF PORTABLE ORP MONITOR	10	A4
33.	PE-V0-512-156-W024	DATA SHEET OF CORROSION TEST RACK AND COUPON	10	A4
34.	PE-V0-512-156-W003F	MQP FOR MOTORS	10	A4
35.	PE-V0-512-156-W003C	MQP FOR INSTRUMENTS AND MONITORING EQUIPMENTS	10	A4
36.	PE-V0-512-156-W037	MQP FOR DIAPHRAGM VALVE	10	A4
37.	PE-V0-512-156-W038	MQP FOR BALL VALVE	10	A4
38.	PE-V0-512-156-W039	MQP FOR FORGE CHECK VALVE	10	A4
39.	PE-V0-512-156-W040	MQP FOR CCS/CSS CHECK VALVE	10	A4
40.	PE-V0-512-156-W003	MQP for TANK AND SKID	10	A4
41.	PE-V0-512-156-W003A	MQP FOR PUMPS (CENTRIFUGAL) - ACID DILUTION PUMP	10	A4
42.	PE-V0-512-156-W003B	MQP FOR PUMP (POSITIVE DISPLACEMENT)	10	A4
43.	PE-V0-512-156-W003D	MQP FOR VALVES (GATE VALVE)	10	A4
44.	PE-V0-512-156-W003E	MQP FOR PIPES	10	A4
45.	PE-V0-512-156-W003H	MQP FOR AGITATOR	10	A4
46.	PE-V0-512-156-W003I	MQP FOR LIME PIT EFFLUENT DISPOSAL PUMPS	10	A4
47.	PE-V0-512-156-W003J	MQP FOR SULPHURIC ACID UNLOADING PUMPS	10	A4

MASTER DRAWING LIST OF OXYGEN DOSING SYSTEM

SL. NO.	BHEL DRG NO	DRG TITLE	SCHEDULE OF SUBMISSION FROM LOI IN WEEKS	DRG/ DOC SIZE
1	PE-V0-512-154-W001*	P&ID for Oxygen Dosing System	2	A3
2	PE-V0-512-154-W002*	GA drawing and foundation detail for Oxygen Dosing System	2	A4
3	PE-V0-512-154-W003*	Technical Data sheet for Oxygen Dosing System	4	A4
4	PE-V0-512-154-W004*	Junction Box Termination Dwgs. for Oxygen Dosing System	4	A4
5	PE-V0-512-154-W005*	QAP for Oxygen Dosing System	2	A4
6	PE-V0-512-154-W006	O&M Manual for Oxygen Dosing System	16	A4

MASTER DRAWING LIST OF CHEMICAL DOSING SYSTEM

SL. NO.	BHEL DRG NO	DRG TITLE	SCHEDULE OF SUBMISSION FROM LOI IN WEEKS	DRG/ DOC SIZE
1.	PE-V0-512-154-W101*	P&I DIAGRAM FOR CHEMICAL DOSING SYSTEM	2	A3
2.	PE-V0-512-154-W102*	TECHNICAL DATA SHEET-CHEMICAL DOSING SYSTEM	4	A4
3.	PE-V0-512-154-W103*	GA DRAWING & FOUNDATION DETAILS	2	A4
4.	PE-V0-512-154-W104*	LOCAL CONTROL PANEL (INCLUDING WIRING DIAGRAM, LOGIC DIAGRAM AND FIELD TERMINATION DETAILS) - CDS	4	A4
5.	PE-V0-512-154-W105*	QAP FOR CHEMICAL DOSING SYSTEM	2	A4
6.	PE-V0-512-154-W106	O&M MANUAL FOR CHEMICAL DOSING SYSTEM	16	A4

MASTER DRAWING LIST OF LIME DOSING SYSTEM

SL. NO.	BHEL DRG NO	DRG TITLE	SCHEDULE OF SUBMISSION FROM LOI IN WEEKS	DRG/ DOC SIZE
1.	PE-V0-512-571-19000-W101*	GAD of Lime dosing system	6	A4
2.	PE-V0-512-571-19000-W102*	Technical data sheet of Lime dosing system skid mechanical, electrical & C&I components	10	A4
3.	PE-V0-512-571-19000-W103*	GA & Wiring diagram of LCP	10	A4
4.	PE-V0-512-571-19000-W104	O&M Manual	16	A4
5.	PE-V0-512-571-19000-W105*	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM WITH SET POINTS, I/O list, Control Scheme	10	A4
6.	PE-V0-512-571-19000-W106*	QAP For Lime Dosing System	10	A4

MASTER DRAWING LIST OF DM PLANT

S. NO.	VENDOR DRAWING NO	DRAWING TITLE	NO. OF WEEKS FOR DOCUMENT SUBMISSION AFTER PLACING LOI/ LOA	DRG/ DOC SIZE
1.	PE-V0-512-163-W001*	P&I DIAGRAM FOR DM PLANT	4	A1
2.	PE-V0-512-163-W002*	PROCESS DESIGN & EQUIPMENT SIZING CALCULATION (DM PLANT)	4	A4
3.	PE-V0-512-163-W003*	PRESSURE DROP CALCULATION FOR DM PLANT	4	A4
4.	PE-V0-512-163-W004*	EQUIPMENT LAYOUT PLAN OF DM PLANT	4	A0
5.	PE-V0-512-163-W005	PIPING LAYOUT DRGS (DM PLANT AREA)	10	A1
6.	PE-V0-512-163-W006	PIPE SCHEDULE FOR DM PLANT	10	
7.	PE-V0-512-163-W007*	PRESSURE VESSEL DESIGN CALCULATION & THICKNESS CALCULATIONS	4	A4
8.	PE-V0-512-163-W008*	SYSTEM DESCRIPTION AND CONTROL WRITE UP FOR DM PLANT	6	A4
9.	PE-V0-512-163-W010	MQP FOR MS PIPES	10	A4
10.	PE-V0-512-163-W011	MQP FOR SS PIPES	10	A4
11.	PE-V0-512-163-W012	MQP FOR CS PIPES	10	A4
12.	PE-V0-512-163-W016	DRIVE LIST & IO LIST (FOR DDCMIS) FOR DM PLANT	10	A4
13.	PE-V0-512-163-W017	INSTRUMENT SCHEDULE FOR DM PLANT	10	A4
14.	PE-V0-512-163-W018	AC/ DC POWER DISTRIBUTION SCHEME & GAS OF LPDBS	12	A4
15.	PE-V0-512-163-W019	PAINTING SCHEDULE FOR DM	10	A4
16.	PE-V0-512-163-W020	DATA SHEET FOR CONTROL VALVES, ACTUATORS AND ACCESSORIES	10	A4
17.	PE-V0-512-163-W021	LIST OF ALARMS AND SET POINTS	10	A4
18.	PE-V0-512-163-W022	CIVIL ASSIGNMENT OF DM PLANT	10	A4
19.	PE-V0-512-163-W023	GA OF PRESSURE VESSEL FOR DMP	10	A2
20.	PE-V0-512-163-W024	DATA SHEET FOR ACTIVATED CARBON	10	A4
21.	PE-V0-512-163-W025	DATASHEET FOR RESINS	10	A4
22.	PE-V0-512-163-W026	DATA SHEET AND GA FOR AIR BLOWER FOR DM PLANT	10	A4
23.	PE-V0-512-163-W027	DATA SHEET FOR PT & DPT TRANSMITTERS FOR DM PLANT	10	A4
24.	PE-V0-512-163-W028	DATA SHEET FOR ULTRASONIC TYPE LEVEL TRANSMITTERS FOR DM PLANT	10	A4
25.	PE-V0-512-163-W030	DATA SHEET FOR TEMP/TRANSMITTER	10	A4
26.	PE-V0-512-163-W031	DATA SHEET FOR PH ANALYSER FOR DM PLANT	10	A4
27.	PE-V0-512-163-W032	DATA SHEET FOR CONCENTRATION ANALYSER	10	A4
28.	PE-V0-512-163-W033	DATA SHEET FOR CONDUCTIVITY ANALYSER	10	A4
29.	PE-V0-512-163-W034	DATA SHEET FOR SILICA ANALYSER	10	A4
30.	PE-V0-512-163-W035	DATA SHEET FOR SODIUM ANALYSER	10	A4
31.	PE-V0-512-163-W036	DATA SHEET OF SOLENOID VALVES	10	A4
32.	PE-V0-512-163-W037	GA FOR ATMOSPHERIC TANK OF DM PLANT	10	A2
33.	PE-V0-512-163-W039	VALVE SCHEDULE FOR DM PLANT	12	A4
34.	PE-V0-512-163-W040	MQP FOR PRESSURE VESSEL/ ATM. STORAGE TANKS	10	A4
35.	PE-V0-512-163-W041	MQP FOR CENTRIFUGAL PUMPS (HORIZONTAL & VERTICAL)	10	A4

36.	PE-V0-512-163-W042	MQP FOR RUBBERLINED PUMP	10	A4
37.	PE-V0-512-163-W043	MQP FOR AIR BLOWER (LOBE TYPE)	10	A4
38.	PE-V0-512-163-W044	MQP FOR AIR BLOWER (CENTRIFUGAL)	10	A4
39.	PE-V0-512-163-W045	MQP FOR AGITATOR/ MIXER	10	A4
40.	PE-V0-512-163-W046	MQP FOR VERTICAL CENTRIFUGAL PUMP	10	A4
41.	PE-V0-512-163-W047	MQP FOR OTHER MISCELLANEOUS BOI'S	10	A4
42.	PE-V0-512-163-W048	CABLE INTERCONNECTION (C&I) FOR DM PLANT	10	A4
43.	PE-V0-512-163-W049	DATA SHEET, GA, TERMINAL BOX DETAILS & CHRACTERSTIC CURVE FOR FILTER PUMP-MOTOR	10	A4
44.	PE-V0-512-163-W051	MQP FOR ELECTRICAL ACTUATOR & GEAR BOX	10	A4
45.	PE-V0-512-163-W057	QP FOR PLUG VALVE (M/S WEIR BDK)	10	A4
46.	PE-V0-512-163-W058	QP FOR RO PRESSURE TUBE (M/S PENTAIR)	10	A4
47.	PE-V0-512-163-W059	LOAD LIST OF DM PLANT	10	A4
48.	PE-V0-512-163-W060	DATA SHEET OF MOTOR FOR DM PLANT	10	A4
49.	PE-V0-512-163-W061	DATA SHEET FOR VALVE FOR DM PLANT	10	A4
50.	PE-V0-512-163-W062	MQP FOR DUAL PLATE CHECK VALVES	10	A4
51.	PE-V0-512-163-W063	MQP FOR BALL VALVES	10	A4
52.	PE-V0-512-163-W064	MQP FOR BUTTERFLY VALVES	10	A4
53.	PE-V0-512-163-W065	MQP FOR GATE/ GLOBE/ CHECK VALVES	10	A4
54.	PE-V0-512-163-W067	MQP FOR DIAPHRAGM VALVE	10	A4
55.	PE-V0-512-163-W068	MQP FOR METERING PUMP (DIAPHRAGM TYPE)	10	A4
56.	PE-V0-512-163-W069	MQP FOR PP PUMPS	10	A4
57.	PE-V0-512-163-W070	DATASHEET FOR ELECTRIC HEATER	10	A4
58.	PE-V0-512-163-W071	PG TEST PROCEDURE FOR DM PLANT	20	A4
59.	PE-V0-512-163-W073	O&M MANUAL (DM PLANT)	24	A4
60.	PE-V0-512-163-W075	CABLE TRAY ROUTING DRG SHOWING INSERTS, TRENCHES, TRESTLE, SLIT ETC/ DETAILS FOR DM PLANT BUILDING/ STRUCTURES / MCC ROOM	10	A1
61.	PE-V0-512-163-W076	CABLE SCHEDULE (C&I) FOR DM PLANT	12	A4
62.	PE-V0-512-163-W077	GA & DATA SHEET FOR UF MEMBRANE	10	A4
63.	PE-V0-512-163-W083	TECHNICAL DATA SHEET FOR HORIZONTAL/VERTICAL CENTRIFUGAL PUMP WITH MOTOR OF DM PLANT	10	A4
64.	PE-V0-512-163-W084	TECHNICAL DATA SHEET FOR EJECTORS OF DM PLANT	10	A4
65.	PE-V0-512-163-W086	TECHNICAL DATA SHEET OF MEASURING INSTRUMENTS (PG, TI, FI ETC.)	10	A4
66.	PE-V0-512-163-W087	SUB-VENDOR LIST & INSPECTION CRITERION FOR DM PLANT.	10	A4
67.	PE-V0-512-163-W092	TYPE TEST REPORT OF TRANSMITTERS, INSTRUMENTS, FLOW ELEMENT, CONTROL VALVE.	10	A4
68.	PE-V0-512-163-W093	CONTROL SCHEME OF DM PLANT	12	A4
69.	PE-V0-512-163-W095	INSTRUMENT HOOK UP	12	A4
70.	PE-V0-512-163-W096	DATASHEET & GA OF JUNCTION BOX.	10	A4
71.	PE-V0-512-163-W097	DATASHEET & GAD OF AGITATOR WITH MOTOR - DMP	10	A4
72.	PE-V0-512-163-W106	DATA SHEET AND GA FOR TWIN LOBE BLOWER FOR DM	10	A4
73.	PE-V0-512-163-W107	DATASHEET FOR MANUAL DIAPHRAGM VALVE	10	A4
74.	PE-V0-512-163-W108	DATASHEET FOR PNEUMATCIALLY OPERATED DIAPHRAGM VALVE	10	A4
75.	PE-V0-512-163-W109	DATASHEET FOR DUAL PLATE CHECK VALVE	10	A4

76.	PE-V0-512-163-W110	DATA SHEET OF MANUAL BALL VALVE FOR DM PLANT	10	A4
77.	PE-V0-512-163-W111	DATASHEET & GAD OF EFFLUENT DISPOSAL PUMP	10	A4
78.	PE-V0-512-163-W112	DATASHEET & GAD OF BACKWASHED WATER TRANSFER PUMP	10	A4
79.	PE-V0-512-163-W113	DATASHEET & GAD OF ACID UNLOADING PUMP	10	A4
80.	PE-V0-512-163-W115	DATA SHEET FOR ORP ANALYSER FOR DM PLANT	10	A4
81.	PE-V0-512-163-W116	MQP FOR RUBBER LINING	10	A4
82.	PE-V0-512-163-W133	QP FOR PRESSURE VESSELS/ ATM. TANK, ACID & ALAKLI STORAGE TANK.	10	A4
83.	PE-V0-512-163-W135	DATASHEET & GA DRAWING FOR PLUG VALVES	10	A4
84.	PE-V0-512-163-W136	DATASHEET & GA DRAWING FOR GLOBE VALVES	10	A4
85.	PE-V0-512-163-W140	DATASHEET & GA DRAWING OF FLAP TYPE NRV	10	A4
86.	PE-V0-512-163-W141	QP FOR PRESSURE VESSELS/ ATM. TANK	10	A4
87.	PE-V0-512-163-W143	TYPE TEST REPORT OF INSTRUMENT CABLE	10	A4
88.	PE-V0-512-163-W145	TYPE TEST REPORT OF CONTROL VALVE FOR DM PLANT (CV TEST REPORT)	10	A4
89.	PE-V0-512-163-W038	DATASHEET AND GA DRAWING FOR UF MODULE AND PRESSURE VESSEL	10	A4
90.	PE-V0-512-163-W050	DATASHEET AND GA DRAWING FOR UF MODULE AND PRESSURE VESSEL	10	A4
91.	PE-V0-512-163-W052	DATASHEET AND GA DRAWING FOR RO HIGH PRESSURE PUMP	10	A4

MASTER DRAWING LIST OF PT PLANT

S. NO.	VENDOR DRAWING NO	DRAWING TITLE	NO. OF WEEKS FOR DOCUMENT SUBMISSION AFTER PLACING LOI/ LOA	DRG/ DOC SIZE
1.	PE-V0-512-158-W001*	P&ID FOR PRE-TREATMENT PLANT	**4**	**A1**
2.	PE-V0-512-158-W002*	PROCESS DESIGN, EQUIPMENT SIZING, HYDRAULIC & DROP CALCULATION FOR PT PLANT	**4**	**A4**
3.	PE-V0-512-158-W005*	LAYOUT OF PT PLANT	**6**	**A0**
4.	PE-V0-512-158-W011	G.A DRAWING & DATA SHEET FOR REACTOR CLARIFIER FOR PTCW & DM SYSTEM	**8**	**A1**
5.	PE-V0-512-158-W013*	G.A OF CHEMICAL HOUSE INCLUDING OVERHEAD TANK (TOP OF CHEMICAL HOUSE)	**12**	**A1**
6.	PE-V0-512-158-W014	G.A OF GRAVITY FILTER HOUSE, FILTER WATER RESRVOIR & PUMP HOUSE (PT DM)	**10**	**A1**
7.	PE-V0-512-158-W016*	WATER TREATMENT PLANT -LAYOUTS AND DETAILS OF INTERCONNECTING PATHWAYS AND PAVING DETAILS FOR ALL FACILITIES	**12**	**A1**
8.	PE-V0-512-158-W017*	WTP-CIVIL GA, FOUND., SUPER STRUCTURE & RCC DETAILS OF CASCADE AERATOR, STILLING CHAMBER, PARSHALL FLUME CHAMBER FOR PT - CW SYSTEM	**10**	**A1**
9.	PE-V0-512-158-W018*	WATER TREATMENT PLANT - CIVIL GA, FOUNDATION, SUPER STRUCTURE & RCC DETAILS OF AERATOR, STILLING CHAMBER, PARSHALL FLUME AND INLET CHAMBER (FOR PT - DM)	**10**	**A1**
10.	PE-V0-512-158-W019*	WATER TREATMENT PLANT – CIVIL GA AND SECTIONAL DETAILS OF PT-CW CLARIFIER	**8**	**A1**
11.	PE-V0-512-158-W020*	WATER TREATMENT PLANT – RCC DETAILS OF	**8**	**A1**

		PT-CW CLARIFIER		
12.	PE-V0-512-158-W021*	WATER TREATMENT PLANT – CIVIL GA AND SECTIONAL DETAILS OF PT-DM CLARIFIER	**8**	**A1**
13.	PE-V0-512-158-W022*	WATER TREATMENT PLANT – RCC DETAILS OF PT-DM CLARIFIER	**8**	**A1**
14.	PE-V0-512-158-W023*	WATER TREATMENT PLANT -GRAVITY FILTER HOUSE - ARCHITECTURAL FLOOR PLAN AT GROUND FLOOR, CHANNEL CUM WALKWAY AND ROOF	**10**	**A1**
15.	PE-V0-512-158-W024*	CIVIL GA OF GRAVITY FILTER HOUSE, FILTERED WATER RESERVOIR, SUMP AND PUMP HOUSE FOR PTP	**10**	**A1**
16.	PE-V0-512-158-W025*	RCC DETAILS OF GRAVITY FILTER HOUSE, FILTERED WATER RESERVOIR, SUMP AND PUMP HOUSE FOR PTP	**10**	**A4**
17.	PE-V0-512-158-W039*	WATER TREATMENT PLANT - CIVIL GA & RC DETAILS OF SLUDGE SUMP & BACKWASH WASTE COLLECTION PIT	**12**	**A1**
18.	PE-V0-512-158-W045*	WATER TREATMENT PLANT - CIVIL ANALYSIS AND DESIGN OF AERATOR/ STILLING CHAMBER ETC.FOR PT-CW	**10**	**A4**
19.	PE-V0-512-158-W046*	WATER TREATMENT PLANT – CIVIL ANALYSIS AND DESIGN OF AERATOR /STILLING CHAMBER ETC. FOR DM	**10**	**A4**
20.	PE-V0-512-158-W047*	WATER TREATMENT PLANT - CIVIL ANALYSIS AND DESIGN OF PT-CW CLARIFIERS	**10**	**A4**
21.	PE-V0-512-158-W048*	WATER TREATMENT PLANT - CIVIL ANALYSIS AND DESIGN OF PT-DM CLARIFIERS	**10**	**A4**
22.	PE-V0-512-158-W050*	WATER TREATMENT PLANT -GRAVITY FILTER HOUSE - ANALYSIS AND DESIGN OF SUPERSTRUCTURE & FOUNDATION	**12**	**A4**
23.	PE-V0-512-158-W054*	WATER TREATMENT PLANT – CIVIL ANALYSIS AND DESIGN OF SLUDGE SUMP & BACKWASH COLLECTION PIT	**12**	**A4**
24.	PE-V0-512-158-W058	DATASHEET AND GA OF AIR BLOWER FOR PTP PLANT	**12**	**A4**
25.	PE-V0-512-158-W060	ELECTRICAL HOIST GA AND DATA SHEET FOR CHEMICAL HOUSE	**10**	**A4**
26.	PE-V0-512-158-W061	PIPE SCHEDULE FOR PT PLANT	**8**	**A4**
27.	PE-V0-512-158-W062	VALVE SCHEDULE FOR PT PLANT	**8**	**A4**
28.	PE-V0-512-158-W063	OPERATION & MAINTENANCE MANUAL FOR WTP	**24**	**A4**
29.	PE-V0-512-158-W064	GA and Data Sheet for Vertical Pumps with Motors	**12**	**A4**
30.	PE-V0-512-158-W065	INSTRUMENT SCHEDULE PT	**8**	**A4**
31.	PE-V0-512-158-W066	LIST OF ALARM FOR PT PLANT AREA	**10**	**A4**
32.	PE-V0-512-158-W067	INTERCONNECTION DIAGRAM DM	**12**	**A4**
33.	PE-V0-512-158-W068	INSTRUMENTS HOOK UP DRAWINGS (PT-DM PLANT AREA)	**18**	**A4**
34.	PE-V0-512-158-W069	TYPE TEST REPORTS OF TRANSMITTERS, INST CABLES & CONTROL CABLES	**18**	**A4**
35.	PE-V0-512-158-W070	TYPE TEST REPORT OF JUNCTION BOX (DEGREE OF PROTECTION)	**18**	**A4**
36.	PE-V0-512-158-W071	DATA SHEET FOR ULTRASONIC TYPE LEVEL TRANSMITTERS	**16**	**A4**
37.	PE-V0-512-158-W072	DATA SHEET FOR PRESSURE TRANSMITTER	**16**	**A4**
38.	PE-V0-512-158-W073	LOGIC DIAGRAM FOR PT PLANT	**18**	**A4**
39.	PE-V0-512-158-W074	DATA SHEET FOR LOCAL GAUGES (PRESSURE INDICATOR/ DIFFERENTIAL PRESSURE INDICATOR/ TEMPERATURE INDICATOR/ VACUUM GAUGE/ LEVEL INDICATOR)	**16**	**A4**
40.	PE-V0-512-158-W075	DATA SHEET OF FLOW TRANSMITTERS	**14**	**A4**
41.	PE-V0-512-158-W077	G.A & DATASHEET OF BUTTERFLY VALVE FOR	**12**	**A4**

		PT PLANT		
42.	PE-V0-512-158-W078	DATASHEET AND GA OF PLUG VALVE FOR WWRO	**12**	**A4**
43.	PE-V0-512-158-W079	G.A & DATASHEET OF GLOBE VALVE FOR PT PLANT	**12**	**A4**
44.	PE-V0-512-158-W080	G.A & DATASHEET OF NON-RETURN VALVE FOR PT PLANT	**12**	**A4**
45.	PE-V0-512-158-W081	G.A & DATASHEET OF MANUAL & MOTORISED GATE VALVES FOR PT PLANT	**12**	**A4**
46.	PE-V0-512-158-W082	DATASHEET & GAD OF DIAPHRAM VALVE FOR PT PLANT	**12**	**A4**
47.	PE-V0-512-158-W084	GA & TDS of Sluice Gate (Penstock)	**12**	**A4**
48.	PE-V0-512-158-W085	MQP FOR PLUG VALVES	**12**	**A4**
49.	PE-V0-512-158-W088	G.A & DATASHEET OF AGITATOR FOR PT PLANT	**12**	**A4**
50.	PE-V0-512-158-W091	MQP FOR AIR BLOWERS -LOBE TYPE > = 5 KW-ENDORSEMENT	**12**	**A4**
51.	PE-V0-512-158-W092	MQP FOR VALVE- DIAPHGRAGM TYPE	**12**	**A4**
52.	PE-V0-512-158-W093	MQP FOR VALVE- BUTTERFLY	**12**	**A4**
53.	PE-V0-512-158-W095	MQP FORGATE- SLUICE /ISOLATION GATE-ENDORSEMENT	**12**	**A4**
54.	PE-V0-512-158-W096	MQP FOR PIPE-MS (BLACK/GI) - (IS 1239 / IS 3589) (UP TO 1000 NB)-ENDORSEMENT	**14**	**A4**
55.	PE-V0-512-158-W098	MQP FOR PUMPS- HORIZONTAL & VERTICAL CENTRIFUGAL-ENDORSEMENT	**14**	**A4**
56.	PE-V0-512-158-W099	MQP FOR PUMP-METERING/ DOSING-ENDORSEMENT	**14**	**A4**
57.	PE-V0-512-158-W100	MQP FOR PUMPS-SCREW TYPE	**12**	**A4**
58.	PE-V0-512-158-W103	PAINTING SCHEDULE FOR PT PLANT	**10**	**A4**
59.	PE-V0-512-158-W104	PIPING LAYOUT FOR PT PLANT	**20**	**A4**
60.	PE-V0-512-158-W105	MQP FOR ELECTRICAL ACTUATOR (WITH GEAR BOX IF APPLICABLE)	**14**	**A4**
61.	PE-V0-512-158-W101	CABLE SCHEDULE (C&I) [BRANCH CABLE] PT	**12**	**A4**
62.	PE-V0-512-158-W106	I/O & DRIVE LIST- WS (DM/PT)	**12**	**A4**
63.	PE-V0-512-158-W107	GA OF JUNCTION BOX - DM/PT	**12**	**A4**
64.	PE-V0-512-158-W108	GA, CROSS SECTION, CH CURVE AND DATASHEET FOR LIME SLURRY TRANSFER AND LIME DOSING PUMP	**12**	**A4**
65.	PE-V0-512-158-W117*	SYSTEM DESCRIPTION & CONTROL WRITE UP FOR PRE-TREATMENT PLANT	**4**	**A4**
66.	PE-V0-512-158-W118*	BASIC CIVIL DESIGN CRITERIA FOR PT PLANT TALCHER	**4**	**A4**

MASTER DRAWING LIST OF STP

S. NO.	VENDOR DRAWING NO	DRAWING TITLE	NO. OF WEEKS FOR DOCUMENT SUBMISSION AFTER PLACING LOI/ LOA	DRG/ DOC SIZE
1.	PE-V0-492-673-W001*	P&ID, VALVE SCHEDULE & PIPING SCHDULE FOR SEWAGE TREATMENT PLANT	4	A1
2.	PE-V0-492-673-W002*	EQUIPMENT LAYOUT OF SEWAGE TREATMENT PLANT	6	A1
3.	PE-V0-492-673-W003*	CONTROL WRITE UP	4	A4
4.	PE-V0-492-673-W004	CIVIL INPUT DRAWING FOR PACKAGED STP	8	A1
5.	PE-V0-492-673-W005	PIPING LAYOUT INSIDE & OUTSIDE STP AREA ALONG WITH DETAILS OF SUPPORTS	10	A1
6.	PE-V0-492-673-W006	PG TEST PROCEDURE FOR SEWAGE	10	A4

		TREATMENT PLANT – CW SYSTEM CIVIL WORKS		
7.	PE-V0-492-673-W007	DATASHEET & GA OF EQUIPMENTS FOR PACKAGED STP	12	A4
8.	PE-V0-492-673-W008	O&M MANUAL FOR PACKAGE STP -CW	14	A4
9.	PE-V0-492-673-W101	ELECTRICAL LOAD LIST	10	A4
10.	PE-V0-492-673-W201	CABLE SCHEDULE AND INTERCONNECTION DIAGRAM	10	A4
11.	PE-V0-492-673-W202	DATASHEET & GA DRAWING OF MICRO CONTROLLER BASED CONTROL PANEL	10	A4
12.	PE-V0-492-673-W102	CABLE TRAY LAYOUT WITH SUPPORT FOR STP - RW & CW	12	A1
13.	PE-V0-492-673-W401	QAP FOR LOCAL CONTROL PANEL (MICRO CONTROLLER BASED)	10	A4

MASTER DRAWING LIST OF CPU

S. NO.	VENDOR DRAWING NO	DRAWING TITLE	NO. OF WEEKS FOR DOCUMENT SUBMISSION AFTER PLACING LOI/ LOA	DRG/ DOC SIZE
1.	PE-V0-512-155-W037-1	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM FOR CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)	12	A1
2.	PE-V0-512-155-W134	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM FOR CONDENSATE POLISHING UNIT (REGENERATION AREA)	12	A1
3.	PE-V0-512-155-W128	ELECTRICAL LOAD LIST FOR CPU	8	A4
4.	PE-V0-512-155-W121	DATA SHEET OF MOTORS FOR CPP	14	A4
5.	PE-V0-512-155-W029	TECHNICAL DATASHEET ALONG WITH GA DRAWING FOR ELECTRIC HEATER FOR CPU	12	A4
6.	PE-V0-512-155-W011	CONTROL LOGICS FOR CPP	14	A4
7.	PE-V0-512-155-W017	HMI - LOGS, TRENDS AND BAR CHARTS FOR CPP	14	A4
8.	PE-V0-512-155-W130	EARTHING LAYOUT OF CPU SERVICE VESSEL AREA	12	A1
9.	PE-V0-512-155-W131	EARTHING LAYOUT OF CPU REGENERATION AREA	12	A1
10.	PE-V0-512-155-W123	I/O LIST AND DRIVE LIST	12	A4
11.	PE-V0-512-155-W008	LIST OF 230V AC UPS LOAD (FOR CPP)	10	A4
12.	PE-V0-512-155-W048	ALARM AND ANNUNCIATION LIST	10	A4
13.	PE-V0-512-155-W051	INTERCONNECTION SCHEDULE FOR CPP	14	A4
14.	PE-V0-512-155-W124	INSTRUMENTS SCHEDULE FOR FOR CPP	14	A4
15.	PE-V0-512-155-W125	INSTRUMENTATION CABLE LIST & ICS FOR CPP	14	A4
16.	PE-V0-512-155-W012	TYPE TEST REPORT FOR ELECTRONIC TRANSMITTERS (FOR CPP)	16	A4
17.	PE-V0-512-155-W016	TYPE TEST REPORT OF JUNCTION BOX (DEGREE OF PROTECTION) FOR CPP	16	A4
18.	PE-V0-512-155-W132	TYPE TEST REPORT OF CV TEST FOR CONTROL VALVE (FOR CPP)	16	A4
19.	PE-V0-512-155-W022	DATA SHEET FOR ELECTRONIC TRANSMITTERS	16	A4
20.	PE-V0-512-155-W023	DATA SHEET FOR LEVEL TRANSMITTER - ULTRASONIC	16	A4
21.	PE-V0-512-155-W024	DATASHEET OF SOLENOID VALVES	16	A4
22.	PE-V0-512-155-W030	DATA SHEET FOR PNEUMATIC OPERATED	16	A4

		CONTROL VALVES FOR CPP		
23.	PE-V0-512-155-W045	Data Sheet of Motorized Butterfly Valve	16	A4
24.	PE-V0-512-155-W078	DATA SHEET AND GA FOR JUNCTION BOX / ANALYZER PANEL AND JB LAYOUT	16	A4
25.	PE-V0-512-155-W136	DATA SHEETS OF INSTRUMENTS FOR STG BALANCE TG INSTRUMENTS (FOR CPP)	16	A4
26.	PE-V0-512-155-W020	GA OF AC & DC POWER DISTRIBUTION BOARD (FOR CPP)	16	A4
27.	PE-V0-512-155-W032	GA DRAWING OF DM WATER STORAGE TANKS	10	A3
28.	PE-V0-512-155-W033	GA DRAWING OF SERVICE VESSEL	10	A3
29.	PE-V0-512-155-W034	GA DRAWING OF REGENERATION VESSELS	10	A3
30.	PE-V0-512-155-W035	GA DRAWING OF ACID STORAGE TANK	10	A3
31.	PE-V0-512-155-W036	GA DRAWING OF ALKALI STORAGE TANK	10	A3
32.	PE-V0-512-155-W037	GA DRAWING OF ACID MEASURING TANK	10	A3
33.	PE-V0-512-155-W038	GA DRAWING OF ALKALI PREPARATION TANK	10	A3
34.	PE-V0-512-155-W039	GA DRAWING OF ALKALI DAY TANK	10	A3
35.	PE-V0-512-155-W040	GA DRAWING OF AC FILTER FOR ALKALI	10	A3
36.	PE-V0-512-155-W041	GA DRAWING OF HOT WATER TANK	10	A3
37.	PE-V0-512-155-W042	GA DRAWING OF PRIMING TANK OF NEUTRALISATION PIT	10	A3
38.	PE-V0-512-155-W043	GA DRAWING OF LIME TANK OF NEUTRALISATION PIT	10	A3
39.	PE-V0-512-155-W046	GA FOR RESIN MAKE-UP HOPPER	10	A3
40.	PE-V0-512-155-W047	GA FOR RESIN TRANSFER WASTE WATER COLLECTION SUMP (IF APPLICABLE)	10	A3
41.	PE-V0-512-155-W119	CIVIL SCOPE OF SERVICE VESSEL AERA	12	A1
42.	PE-V0-512-155-W127	CIVIL SCOPE DRG FOR REGN AREA	12	A1
43.	PE-V0-512-155-W002*	EQUPMENT LAYOUT OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)	6	A1
44.	PE-V0-512-155-W003*	EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (REGENERATION AREA)	6	A1
45.	PE-V0-512-155-W052	EXTERNAL PIPING LAYOUT FROM CPP SERVICE VESSELS TO REGENERATION AREA	18	A1
46.	PE-V0-512-155-W053	EXTERNAL PIPING LAYOUT IN REGENERATON AREA	18	A1
47.	PE-V0-512-155-W054	PIPING LAYOUT AROUND SERVICE VESSELS	18	A1
48.	PE-V0-512-155-W055	INTERNAL PIPING LAYOUT IN REGENERATION BUILDING	18	A1
49.	PE-V0-512-155-W056	YARD PIPING FROM N-PIT TO ASH SLURRY SUMP	18	A0
50.	PE-V0-512-155-W049	PIPING SCHEDULE (LINE LIST) FOR CPP	8	A4
51.	PE-V0-512-155-W050	VALVE SCHEDULE (VALVE LIST) FOR CPP	8	A4
52.	PE-V0-512-155-W122	PAINTING SCHEDULE FOR CPU	8	A4
53.	PE-V0-512-155-W001*	P& I DIAGRAM OF CONDENSATE POLISHING UNIT (LEGENDS)	4	A1
54.	PE-V0-512-155-W001-1*	P & I DIAGRAM OF CONDENSATE POLISHING PLANT (CPP)	4	A1
55.	PE-V0-512-155-W001-2*	P & I DIAGRAM OF CONDENSATE POLISHING PLANT (CPP)	4	A1
56.	PE-V0-512-155-W001-3*	P & I DIAGRAM OF REGENERATION SYSTEM OF CPP	4	A1
57.	PE-V0-512-155-W133	TYPE TEST REPORT FOR FLOW NOZZLES & ORIFICE PLATES (FOR CPP)	16	A1
58.	PE-V0-512-155-W004*	PROCESS CALCULATION AND EQUIPMENT SIZING FOR CPP	4	A4
59.	PE-V0-512-155-W004-1*	THICKNESS CALCULATION FOR PRESSURE VESSEL FOR CPP	4	A4
60.	PE-V0-512-155-W004-2*	PRESSURE DROP CALCULATION FOR CPP	4	A4

61.	PE-V0-512-155-W006*	OPERATION & CONTROL PHILOSOPHY FOR CPU	4	A4
62.	PE-V0-512-155-W057	PERFORMANCE & GUARANTEE TEST PROCEDURE FOR CONDENSATE POLISHING PLANT	18	A4
63.	PE-V0-512-155-W058	O&M MANUAL OF CPP	20	A4
64.	PE-V0-512-155-W004-3	DATASHEET OF RESIN	4	A4
65.	PE-V0-512-155-W021	DATASHEET AND GA OF ANALYSER RACK/PANEL	12	A4
66.	PE-V0-512-155-W025	DATA SHEET FOR AIR FILTER REGULATOR	12	A4
67.	PE-V0-512-155-W026	DATA SHEET FOR PH ANALYSER	14	A4
68.	PE-V0-512-155-W027	DATA SHEET FOR SODIUM ANALYSER	14	A4
69.	PE-V0-512-155-W028	DATA SHEET FOR CONDUCTIVITY ANALYSER	14	A4
70.	PE-V0-512-155-W059	DATA SHEET OF AC FILTER MEDIA	12	A4
71.	PE-V0-512-155-W061	DATA SHEET ALONG WITH GA OF DUAL PLATE VALVE	14	A4
72.	PE-V0-512-155-W063	DATA SHEET ALONG WITH GA OF BALL VALVE (MANUAL)	14	A4
73.	PE-V0-512-155-W064	DATA SHEET ALONG WITH GA OF BALL VALVE (AUTO)	14	A4
74.	PE-V0-512-155-W065	DATA SHEET ALONG WITH GA OF HIGH PR BALL VALVE (MANUAL)	14	A4
75.	PE-V0-512-155-W066	DATA SHEET ALONG WITH GA OF HIGH PR BALL VALVE (AUTO)	14	A4
76.	PE-V0-512-155-W068	DATA SHEET ALONG WITH GA, C/S AND CH. CURVE OF REGENERATION PUMPS	14	A4
77.	PE-V0-512-155-W069	DATA SHEET ALONG WITH GA, C/S AND CH. CURVE OF ACID UNLOADING PUMPS	14	A4
78.	PE-V0-512-155-W070	DATA SHEET ALONG WITH GA, C/S AND CH. CURVE OF ALKALI UNLOADING PUMPS	14	A4
79.	PE-V0-512-155-W071	DATA SHEET ALONGWITH GA, C/S AND CH. CURVE OF EFFLUENT DISPOSAL PUMPS	14	A4
80.	PE-V0-512-155-W072	DATA SHEET ALONG WITH GA, C/S AND CH. CURVE OF METERING PUMPS (ALKALI)	14	A4
81.	PE-V0-512-155-W073	DATA SHEET ALONG WITH GA, C/S AND CH. CURVE OF METERING PUMPS (ACID)	14	A4
82.	PE-V0-512-155-W074	DATA SHEET ALONG WITH GA, C/S OF BLOWERS OF SERVICE AREA	14	A4
83.	PE-V0-512-155-W075	DATA SHEET ALONG WITH GA, C/S OF BLOWERS OF REGENERATION AREA	14	A4
84.	PE-V0-512-155-W076	DATA SHEET OF SAFETY SHOWERS	14	A4
85.	PE-V0-512-155-W077	DATA SHEET OF AGITATORS FOR ALKALI PREPARATION AND ALKALI DAY TANK	14	A4
86.	PE-V0-512-155-W079	DATA SHEET ALONG WITH GA OF DIAPHRAGM VALVE (MANUAL)	14	A4
87.	PE-V0-512-155-W080	DATA SHEET ALONG WITH GA OF DIAPHRAGM VALVE (AUTO)	14	A4
88.	PE-V0-512-155-W081	DATA SHEET ALONG WITH GA OF BUTTERFLY VALVE (MANUAL)	14	A4
89.	PE-V0-512-155-W082	DATA SHEET ALONG WITH GA OF BUTTERFLY VALVE (AUTO)	14	A4
90.	PE-V0-512-155-W083	DATA SHEET ALONG WITH GA OF HIGH PR BUTTERFLY VALVE (MANUAL)	14	A4
91.	PE-V0-512-155-W084	DATA SHEET ALONG WITH GA OF HIGH PR BUTTERFLY VALVE (AUTO)	14	A4
92.	PE-V0-512-155-W085	DATA SHEET ALONG WITH GA, C/S AND CH. CURVE OF ALKALI TRANSFER PUMPS		A4
93.	PE-V0-512-155-W086	DATA SHEET ALONG WITH GA, C/S AND CH. CURVE OF DM WATER PUMPS FOR RESIN TRANSFER	14	A4
94.	PE-V0-512-155-W087	DATA SHEET ALONG WITH GA, C/S AND CH. CURVE OF RESIN TRANSFER WASTE WATER	14	A4

		RECYCLE PUMPS		
95.	PE-V0-512-155-W138	DATASHEET AND GA OF PRE-FILTERS	14	A4
96.	PE-V0-512-155-W139	DATA SHEET FOR INSTRUMENTATION CABLE F & G TYPE (FOR CPP)	14	A4
97.	PE-V0-512-155-W141	DATA SHEET ALONG WITH GA OF COMPRESSOR & GA DRAWING FOR AIR RECEIVER FOR CPU	14	A4
98.	PE-V0-512-155-W142	DATA SHEET ALONG WITH GA OF NON-RETURN VALVE	14	A4
99.	PE-V0-512-155-W086A	MOTOR DATASHEET FOR DM WATER PUMPS FOR RESIN TRANSFER FOR CPU	12	A4
100.	PE-V0-512-155-W089	MQP FOR ELECTRIC ACTUATOR (WITH GEAR BOX)	14	A4
101.	PE-V0-512-155-W143	MQP FOR SERVICE VESSEL	12	A4
102.	PE-V0-512-155-W096	MQP FOR HORIZONTAL CENTRIFUGAL PUMPS	14	A4
103.	PE-V0-512-155-W100	MQP FOR METERING PUMPS (DIAPHRAGM TYPE)	14	A4
104.	PE-V0-512-155-W101	MQP FOR AIR BLOWER (LOBE TYPE)	14	A4
105.	PE-V0-512-155-W102	MQP FOR RUBBER LINING	12	A4
106.	PE-V0-512-155-W103	MQP FOR FABRICATION OF HIGH-PRESSURE PIPES & FITTINGS	14	A4
107.	PE-V0-512-155-W105	MQP FOR BUTTERFLY VALVES (MANUAL & PNEU/ELEC) UPTO 300# CLASS	14	A4
108.	PE-V0-512-155-W107	MQP FOR DIAPHGRAM VALVE (MANUAL/PNEU.)	14	A4
109.	PE-V0-512-155-W109	MQP FOR DUAL PLATE TYPE VALVES (SS & CI CLASS 150)	14	A4
110.	PE-V0-512-155-W111	MQP FOR BALL VALVE (UPTO PN 10) (CAT III ITEM- QP IS NOT APPLICABLE)	14	A4
111.	PE-V0-512-155-W007-1	HOOK UP & INSTALLATION DRAWING FOR INSTRUMENTS FOR CPP	16	A4
112.	PE-V0-512-155-W116	MQP FOR SS PIPES (ERW/SEAMLESS)	14	A4
113.	PE-V0-512-155-W014	MQP FOR BUTTERFLY VALVE (MANUAL/PNEUMATIC/MOTOR OPERATED)	14	A4
114.	PE-V0-512-155-W019	WPS FOR MS PIPE (IS: 1239/3589) AT SITE FOR CPU	14	A4
115.	PE-V0-512-155-W044	WPS FOR SS PIPES AT SITE FOR CPU	14	A4
116.	PE-V0-512-155-W009	MQP FOR PRESSURE VESSEL (PRE-FILTER RUBBERLINED-OTHER THAN SERVICE VESSEL)	12	A4

MASTER DRAWING LIST OF ETP

S. NO.	VENDOR DRAWING NO	DRAWING TITLE	NO. OF WEEKS FOR DOCUMENT SUBMISSION AFTER PLACING LOI/ LOA	DRG/ DOC SIZE
1.	PE-V0-512-164-W001	DATASHEET AND GA DRAWING FOR PLUG VALVES FOR ETP	8	A4
2.	PE-V0-512-164-W003	G.A & DATASHEET OF AGITATOR FOR LET PLANT	8	A4
3.	PE-V0-512-164-W005	DATASHEET AND GA DRAWING FOR GATE VALVES FOR ETP	8	A4
4.	PE-V0-512-164-W007	DATASHEET AND GA DRAWING FOR DIAPHRAGM VALVES FOR ETP	8	A4
5.	PE-V0-512-164-W009	DATASHEET AND GA DRAWING FOR BALL VALVES FOR ETP	10	A4
6.	PE-V0-512-164-W011	DATASHEET AND GA DRAWING FOR HORIZONTAL CENTRIFUGAL PUMPS FOR ETP	10	A4

7.	PE-V0-512-164-W012*	P & ID FOR ETP	4	A2
8.	PE-V0-512-164-W013	YARD PIPING LAYOUT FOR ETP	16	A0
9.	PE-V0-512-164-W014	MECH GA FOR LAMELLA CLARIFIER/ TUBE SETTLER FOR ETP	12	A1
10.	PE-V0-512-164-W015	PIPING LAYOUT INSIDE ETP AREA	16	A0
11.	PE-V0-512-164-W016	ELECTRICAL LOAD LIST FOR ETP	14	A4
12.	PE-V0-512-164-W017	DATASHEET AND GA DRAWING FOR SCREW PUMPS FOR ETP	10	A4
13.	PE-V0-512-164-W019	DATASHEET AND GA DRAWING AIR BLOWERS FOR ETP	8	A4
14.	PE-V0-512-164-W020*	EQUIPMENT LAYOUT FOR ETP	4	A1
15.	PE-V0-512-164-W021	G.A & DATASHEET OF NON-RETURN VALVE FOR LET PLANT	8	A4
16.	PE-V0-512-164-W022	DATASHEET AND GA DRG FOR ELECTRIC HOIST/ MANUAL HOIST/ CHAIN PULLEY BLOCK FOR ETP	10	A4
17.	PE-V0-512-164-W023	PG TEST PROCEDURE OF ETP PLANT	20	A4
18.	PE-V0-512-164-W024	CIVIL INPUT DRAWING INSIDE ETP AREA	10	A1
19.	PE-V0-512-164-W025	Datasheet for OIL SKIMMER - ETP	14	A4
20.	PE-V0-512-164-W026	MECHANICAL GA DRG OF RCC SUMPS OUTSIDE ETP AREA	10	A2
21.	PE-V0-512-164-W027	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM INCLUDING JB LOCATION OF INSIDE AND OUTSIDE ETP	16	A2
22.	PE-V0-512-164-W028	GA & DATASHEETS OF MOTORS FOR ETP	12	A4
23.	PE-V0-512-164-W031	GA DRAWING FOR ATMOSPHERIC TANKS FOR ETP	10	A2
24.	PE-V0-512-164-W034	VALVE SCHEDULE FOR LET	6	A3
25.	PE-V0-512-164-W035	PIPE SCHEDULE FOR LET	6	A4
26.	PE-V0-512-164-W037*	PROCESS SIZING, PRESSURE DROP AND HYDRAULIC FLOW CALCULATION FOR ETP	4	A4
27.	PE-V0-512-164-W039*	SYSTEM DESCRIPTION & CONTROL WRITE UP FOR LET	4	A4
28.	PE-V0-512-164-W040	OPERATION & MAINTENENACE MANUAL FOR LET	20	A4
29.	PE-V0-512-164-W041	LIST OF DRIVES, JB GROUPING AND I/O LIST	8	A4
30.	PE-V0-512-164-W042	DATASHEET AND GA DRAWING FOR VERTICAL CENTRIFUGAL PUMPS FOR ETP	10	A4
31.	PE-V0-512-164-W044	PAINTING SCHEDULE FOR LET	8	A4
32.	PE-V0-512-164-W045	DATASHEET AND GA DRAWING FOR ISOLATION GATE FOR ETP	8	A4
33.	PE-V0-512-164-W046	INSTRUMENT SCHEDULE OF ETP	8	A4
34.	PE-V0-512-164-W047	DATA SHEET OF ANALYSERS - ETP	12	A4
35.	PE-V0-512-164-W048	DATA SHEET OF TRANSMITTERS -ETP	12	A4
36.	PE-V0-512-164-W049	DATASHEET OF LOCAL INSTRUMENTS -ETP	12	A4
37.	PE-V0-512-164-W050	CABLE SCHEDULE & CABLE INTERCONNECTION DIAGRAM FOR ETP	12	A4
38.	PE-V0-512-164-W051	DATASHEET OF DATASHEET AND GA FOR JUNCTION BOXES - ETP	12	A4
39.	PE-V0-512-164-W052	LIST OF ALARM & SIGNALS FOR ETP AREA	6	A4
40.	PE-V0-512-164-W054	UPS Load List & ACDB distribution.	10	A4
41.	PE-V0-512-164-W071	QAP FOR VERTICAL CENTRIFUGAL / TURBINE PUMP	10	A4
42.	PE-V0-512-164-W072	QAP FOR HORIZONTAL CENTRIFUGAL PUMP	10	A4
43.	PE-V0-512-164-W073	QAP FOR VERTICAL SCREW PUMP	10	A4

44.	PE-V0-512-164-W074	QAP FOR METERING PUMP	10	A4
45.	PE-V0-512-164-W075	QAP of Air Blower (Lobe Type) less than 5KW	10	A4
46.	PE-V0-512-164-W076	QAP FOR BUTTERFLY VALVE UP TO 600MM & CLASS 150 - ETP	10	A4
47.	PE-V0-512-164-W077	QAP FOR MS PIPES UP TO 1000NB - ETP	10	A4
48.	PE-V0-512-164-W078	QAP FOR SLUICE GATE/ISOLATION GATE - ETP	10	A4
49.	PE-V0-512-164-W079	QAP FOR DIAPHRAGM VALVES (ETP)	10	A4
50.	PE-V0-512-164-W080	QAP FOR PLUG VALVES (ETP)	10	A4
51.	PE-V0-512-164-W081	QAP FOR DUAL PLATE CHECK VALVES (ETP)	10	A4
52.	PE-V0-512-164-W082	QAP FOR BALL VALVES (ETP)	10	A4
53.	PE-V0-512-164-W083	GA & DATA SHEET OF PORTABLE CENTRIFUGE FOR WASTE SERVICE WATER TREATMENT PLANT	10	A4
54.	PE-V0-512-164-W084	DATASHEET AND GA DRG FOR BUTTERFLY VALVE FOR ETP	10	A4
55.	PE-V0-512-164-W085	DATASHEET AND GA DRAWING FOR METERING PUMPS FOR ETP	10	A4
56.	PE-V0-512-164-W086	DATASHEET AND GA DRAWING FOR ELECTRIC HOIST & CHAIN PULLEY BLOCK FOR ETP	12	A4
57.	PE-V0-512-164-W087	INSTRUMENTATION INSTALLTION DIAGRAM	12	A4

(*) Basic engineering documents

ANNEXURE - V

SURFACE PREPARATION & PAINTING

SUB-SECTION–A-12

SURFACE PREPARATION & PAINTING

1.00.00 Specification of surface preparation & painting

1.01.00 Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.

1.02.00 All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.

1.03.00 Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.

1.04.00 All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.

1.05.00 SURFACE PREPARATION

1.05.01 All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.

1.05.02 The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer.

SP1	Solvent cleaning
SP2	Application of rust converter (Ruskil or equivalent grade)
SP3	Power tool cleaning
SP4	Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer)
SP4*	Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns
SP5	Shot blasting/ abrasive blasting.
SP6	Emery sheet cleaning/Manual wire brush cleaning.

1.06.00 APPLICATION OF PRIMER/PAINT

1.06.01 The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.

1.06.02 Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.

1.06.03 Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.

1.06.04 Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.

1.06.05 Following are the Primer/painting schemes envisaged herein:

PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.

PS3* - Zinc Chrome primer (Alkyd base) by dip coat.

PS4 - Synthetic Enamel (long oil alkyd) to IS2932.

PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744

PS9 - Aluminum paint to IS 2339.

PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 degC – 600 degC), IS-13183 Gr.-II (for temperature 200 degC- 400 degC and IS-13183 Gr.-III (for temperature upto 200 degC)

PS13 - Rust preventive fluid by spray, dip or brush.

PS14 - Weldable primer-Deoxaluminate or equivalent.

PS16 - High Build Epoxy CDC mastic `15'.

PS17 - Aliphatic Acrylic Polyurethane CDE134, %V=40.0(min.)

PS18 - Epoxy based TiO2 pigmented coat

PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=35.0(min.)

PS-20 - Epoxy based finish paint

1.06.06 All weld edge preparation for site welding shall be applied with one coat of wieldable primer.

1.06.07 For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.

1.06.08 SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.

1.06.09 a) All un-insulated equipments, pipes, valves etc covered in sub-section A-07 (Steam Turbine & Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron.

The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner:

- Primer coat – Epoxy based zinc phosphate
- Intermediate - Epoxy based TiO2 pigmented coat
- Finish coat - Epoxy based finish coat/Two pack polyurethane coat

b) Equipment, pipes etc. with high temperature shall be painted with heat resistant aluminum paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 micron.

c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard

1.06.10 A) Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows:

Primer : One coat of unmodified epoxy resin along with polymide hardener.

Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct

hardener.

Total thickness of primer and paint should not be less than 400 microns.

B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows:

i) For Indoor vessel, tanks, piping, valves & other equipments:

(a) Surface preparation shall be done either manually or by any other approved method.

(b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns.

(c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns.

(d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns.

Total DFT of paint system shall not be less than 150 microns.

ii) For Outdoor vessel, tanks, piping, valves & other equipments:

(a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard.

(b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.

(c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.

(d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.

The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied.

Total DFT shall not be less than 300 microns.

1.06.11 Primer/Painting Schedule

Sl. No	Description		Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade
				Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)		
A) Power Cycle Piping														As per NTPC Colour shade/ coding scheme
1.	All insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.		SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
2.	All un-insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipment etc.	Design temperature < or equal to 60^0C	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3 **$**	35 **$**	155 **$**	
		Design temperature above 60^0C-200^0C	SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		Design temperature > 200^0C	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH) and Variable Load Hanger (VLH)		SP4*	PS19	1	40	-	-	-	PS17	1	30	70	
4	Piping hangers / supports (other than (3) above. (un-insulated)		SP3/SP5	PS5	2	25	-	-	-	PS4	2	25	100	

	Valves												
5.	Cast/Forged	Design temperature < or equal to 60 degC #	SP3/SP5	PS5	2	35	-	-	-	PS4	2	25	120
		Design temperature above 60 degC	SP3/SP5	PS9*	1	20	-	-	-	PS9*	1	20	40
6.	All auxiliary Structural Steel components for pipe supports	Outside TG building and in SG envelope	SP4*	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a) Epoxy coat b) Final coat of paint PS17	2 1	35 30	250
		Within TG building	SP4*	-do-	1	35	PS18	1	35	a) Epoxy coat b) Final coat of paint PS17	2 1	25 30	150
7.	Weld Edges		SP6 (Hand cleaning by wire brushing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	25

1. **$ -** The first 2 finished coats (total min.DFT of 70 microns) shall be done at shop and the 3rd finish coat (min.DFT 35 Microns) shall be applied at site.
2. For valves below 65NB and temperature upto and including 540 DegC, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint.
3. For corrosion protection of threaded hanger rods and variable spring cages, electro galvanizing in full compliance to minimum Corrosion category C3 as per EN ISO12944 is also acceptable.
4. For spring cages, 2 coats of 30 µm (min) zinc-rich epoxy resin primer with zinc content> 80 weight% in dry film followed by 2 coats of 30 µm (min) top coat of Acrylic resin Co-polymerisate with a total combined minimum DFT of 120µm is also acceptable in lieu of above specified paint scheme.
5. For corrosion protection, all inner parts of the hangers (CLH/VLH) shall be at least in full compliance to Corrosion category C3 as per EN ISO12944.
6. # - For Cast/forged valves upto & including design temperature 60Deg.C, Aluminium painting as per IS-13183 Gr-3 or better with total DFT 40Micron is also acceptable.

B) Steam Generator & Auxiliaries:

1	All surfaces with temperature 95°C or less and which are insulated	SP3/SP4	PS 5	2	30	-	-	-	PS 4	2 **$**	20 **$**	100 **$**
2	All surfaces with temperature above 95°C and which are insulated	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40

Note**:** **1)** SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.

2) Painting specification for all other exposed steel surfaces not covered above shall be same as that given in Civil Sub-section, Part-B, Section VI for corrosion protection of steel structures.

C) LOW PRESSURE PIPING													
1	All Piping, fittings / components, valves, Equipments etc.	SP3/SP5	PS3/ PS5	2	25	PS 4	1	30	PS 4	2	35	150	As per NTPC Color shade/ coding scheme.
2	Stainless steel surface, Galvanized steel surface and gun metal surface.	No Painting											
3	On the internal surface for pipes 1000 Nb and above	A coat of primer followed by hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.											
D) Fire Detection & Protection System, Compressed air system and Air-conditioning & Ventilation System													
For Fire Detection & Protection System, Surface preparation and painting of Fire Water Storage Tanks, all Steel Surfaces (external) exposed to atmosphere (outdoor & indoor installation), Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc. should be as per the Part-B, Sub Section-A-18, Fire Detection & Protection System For Air Conditioning System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Air Conditioning System. For Ventilation System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Ventilation System. For compressed air system, Surface preparation and painting of all the steel surfaces should be as per the Part-B, Sub Section--A-16 compressed air system.												
E) ESP													
1	All surfaces with surface temperature 95°C or less (with or without insulation)	SP3/SP4	PS3/ PS3*	1	25	-	-	-	PS 4	1	30	55	
2	All surfaces with surface temperature above 95°C (with or without insulation)	SP3/SP4	PS5	2	30	-	-	-	-	-	-	60	

General Notes (Applicable for all above points A to E)

i) Painting specification for all surfaces with surface temperature 95°C or less (un-insulated) that are not covered above shall be same as that given in Civil Sub-section, Part-B, Section-VI for corrosion protection of steel structures.

ii) Painting specification for inside surfaces (such as inner surfaces of ducts/ tanks/ mills/ dampers/ ESP etc.) that are not covered specifically in above clauses, shall be provided with 2 coats of suitable primer i.e. PS5/ PS9 (Total DFT 60/40 micron) based on the temperature.

F) FGD System

(i) Surface preparation shall be blast cleaned conforming *to* Sa *2-1/2* Swiss Standard.

(ii) Primer coat shall consist of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.

(iii) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.

(iv) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat *of* polyurethane of minimum DFT of 25 microns shall be provided.

ANNEXURE VI

MANDATORY SPARES AND COMMISSIONING SPARES

1. SPARES

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares. The general requirements pertaining to the supply of these spares is given below:

1.1 MANDATORY SPARES

a) The list of mandatory spares considered essential by the Employer is indicated in this chapter. The bidder shall indicate the prices for each and every item in the price format whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.
b) The Employer reserves the right to buy any or all the mandatory spares parts.
c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.
d) Spares shall not be dispatched before dispatch of corresponding main equipment.
e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

1.2 START-UP & COMMISSIONING SPARES

Start-up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/ system. All spares used till the plant is handed over to the employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipment are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.

1.3 The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spars is given below.

2. The Contractor shall indicate the service expectancy period for the spares parts under normal operating conditions before replacement is necessary.
3. All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.
4. All the spares shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.
5. The contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalise order for recommended spares.
6. Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
7. All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.

8. The contractor will provide the Employer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/ components/ equipment covered under the contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.
9. The Contractor shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.
10. The Contractor shall guarantee the long-term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, he shall give the Employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his subcontractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/ procurement of such items.
11. Material Codification The bidder to provide datasheets/ assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which mandatory spares to be supplied can be uniquely identified. This would facilitate the Employer to assign a unique code to each of the mandatory spare as brought out in GCC. The bidder shall extend all necessary assistance in this regard.
12. Identification: Each spare shall be clearly marked and labelled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.
13. Mandatory spares listed is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified below, same shall be deemed to have been covered in bidder’s scope of supply.
14. Unless stated otherwise, a "set" or "Lot" means items required for complete replacement in one equipment of each type/ size/ range.
15. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the below list.
16. Any item which is quoted as “not applicable” in the above list and is found to be “applicable” at a later date shall be supplied by the Bidder without any commercial implications.

LIST OF MANDATORY SPARES FOR OXYGEN DOSING SYSTEM

SL.NO	DESCRIPTION	QUANTITY
1.	Valves all sizes	5% of the total population of each type, size and class OR minimum 2 nos. of each type size & class whichever is more
2.	**PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING / TUBING AND AIR SUPPLY PIPING AS APPLICABLE)**	
2.1	Valves of all types and models	20 Nos. of each type and model
2.2	2 way, 3way, 5way valve manifolds	10 Nos. of each type, class, size and model
2.3	Fittings	100 Nos. of each type
3.	Transmitters of all types, ranges and model No. (for the measurement of Pressure, differential pressure flow, level, etc.)	10%. or 1 No. of each type and model whichever is more
4.	Pre-fabricated cable with connector of each type	2 nos. of each type
5.	Pressure, Differential Pressure, Flow, level and temperature gauges	20% of the total population or minimum 2 nos of each type/rating/model.
6.	Any other instruments (If applicable)	1 No. each type and model

LIST OF MANDATORY SPARES FOR CHEMICAL DOSING SYSTEM

SL.NO	DESCRIPTION	QUANTITY
1.	Drive shaft cum worm	1 No. for each type of pump per unit.
2.	Drive worm wheel	3 Nos. for each type of pump per unit.
3.	Connecting rod plate	1 No. for each type of pump per unit.
4.	Cross head guide bush	3 Nos. for each type of pump per unit.
5.	Plunger	1 No. for each type of pump per unit.
6.	Plug	1 No. for each type of pump per unit.
7.	Oil seal	1 No. for each type of pump per unit.
8.	Washer	2 Nos. for each type of pump per unit.
9.	Gland nut	2 Nos. for each type of pump per unit.
10.	Motor and motor bearings	1 Set of each type.
11.	Valves all sizes	5% of the total population of each type, size and class OR minimum 2 nos. of each type size & class whichever is more.
12	**PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING / TUBING AND AIR SUPPLY PIPING AS APPLICABLE)**	
12.1	Valves of all types and models	20 Nos. of each type and model
12.2	2 way, 3way, 5way valve manifolds	10 Nos. of each type, class, size and model
12.3	Fittings	100 Nos. of each type

13	Transmitters of all types, ranges and model No. (for the measurement of Pressure, differential pressure flow, level, etc.)	10%. or 1 No. of each type and model whichever is more
14	Pre-fabricated cable with connector of each type	2 nos. of each type
15	Pressure, Differential Pressure, Flow, level and temperature gauges	20% of the total population or minimum 2 nos of each type/rating/model.
16	Agitators	
16.1	Impeller Assembly	1 No. of each type
16.2	Bearing Assembly	2 No. of each type
16.3	Motor	1 No. of each type and rating
16.4	Belt and Pulley (If applicable)	2 nos. of each type
16.5	Gear Box Assembly (If Applicable)	1 nos. of each type
17	Any other instruments (If applicable)	1 No. each type and model

LIST OF COMMISSIONING SPARES FOR CHEMICAL DOSING SYSTEM

SL. No.	ITEM DESCRIPTION	Quantity per skid (No.)	Total Nos.
1.0	**AMMONIA DOSING SYSTEM**		
a.	Oil Seals for drive end.	4	8
b.	Gaskets for drive end	4	8
c.	Guide ring for plunger.	4	8
d.	Teflon rings for valves.	8	16
e.	Level gauge glass	2	4
f.	Back up fuse	3	6
g.	Pilot lamp	2	4
h.	Push Button	2	4
i.	Control fuse	2	4
j.	Bulb for Annunciation	4	8
2.0	**NaOH DOSING SYSTEM**		
a.	Oil Seals for drive end.	4	16
b.	Gaskets for drive end	4	16
c.	Guide ring for plunger.	4	16
d.	Teflon rings for valve/s.	8	32
e.	Level gauge glass	2	8
f.	Back up fuse	3	12
g.	Pilot lamp	2	8
h.	Push Button	2	8
i.	Control fuse	2	8
j.	Bulb for Annunciation	4	16

LIST OF MANDATORY SPARES FOR PRETREATMENT PLANT

Sl. No.	PARTICULARS	QUANTITY
1)	**CLARIFIERS : PT – CW & PT – DM System**	
a)	Rake (Scrapper) drive	1 Set

b)	Turbine drive shaft assembly	1 Set
c)	Rake (Scrapper) drive shaft assembly	1 Set
d)	Worm wheel	1 Set
e)	Worm shaft	1 Set
f)	All Bearings with Motors for turbine drive, and Rack drive	1 Set
	Note: One set consists of quantity required for complete replacement for one clarifier or motor as the case may be	
2)	**Lime Slurry Transfer Pumps, Lime Dosing Pumps**	
a)	Lime Dosing Pump Unit along with Motor	1 No
b)	Lime Slurry Transfer Pump Unit along with Motor	1 No
	Note : One set consists of quantity required for complete replacement for one pump	
3)	**Alum Dosing Pumps : PT – CW & PT – DM System**	
a)	Alum Dosing Pump Unit along with motor (for each system)	1 No
	Note : One set consists of quantity required for complete replacement for one pump	
4)	**Vertical Sump Pumps (For Each Type & Size)**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Complete Casing including suction (if applicable) bell	1 Set
b)	Impeller	1 Set
c)	Wearing rings – Impeller (if applicable)	1 Set
d)	Wearing rings – Casing (if applicable)	1 Set
e)	Impeller Shaft, line shaft and head shaft	1 Set
f)	Shaft Sleeves	1 Set
g)	Stuffing box	1 Set
h)	Line Shaft Couplings (if applicable)	1 Set
i)	Impeller, Line and Head shaft bearings (as applicable)	1 Set
j)	Motor along with bearings	1 Set
	Note : One set consists of quantity required for complete replacement for one pump	
5)	**Agitators**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Agitator Assembly with Motor and Gear Box – Lime Slaking Tank	1 Set
b)	Agitator Assembly with Motor and Gear Box – Lime Preparation Tank – PT System	1 Set
c)	Agitator Assembly with Motor and Gear Box – Alum Preparation Tank	1 Set
d)	Agitator Assembly with Motor and Gear Box – Flash Mixer	1 Set
e)	Agitator Assembly with Motor and Gear Box – Flocculation Tank	1 Set
6)	Valves	
a)	Manual Plug Valve	Min 1 no of each type, rating & size (Set)
b)	Motor operated Plug Valve (without motor actuator)	-do-
c)	Check Valves /Non-return Valve	-do-
d)	Manual Ball Valve	-do-
e)	Motor operated Ball Valve (without motor actuator)	-do-
f)	Manual Globe Valve	-do-

g)	Manual Diaphragm Valve	-do-
h)	Motor operated Diaphragm Valve (without motor actuator)	-do-
i)	Diaphragm for the above Diaphragm Valves	-do-
j)	Manual Butterfly Valve	-do-
k)	Motor operated Butterfly Valve (without motor actuator)	-do-
l)	Manual Gate Valve	-do-
m)	Motor operated Gate Valve (without motor actuator)	-do-
7)	**Gravity Filters for PT-Potable**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Sand and gravel	1.1 times of One full charge for one filter (LOT)
b)	Filter flow rate indicator	1 no of each type /rating
c)	Rate of flow controller	1 no of each type /rating
d)	Back wash filter flow rate indicator	1 no of each type /rating
e)	Differential head indicator	1 no of each type /rating
8)	**Gravity Filters for PT-DM**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Sand and gravel	1.1 times of One full charge for one filter (LOT)
b)	Filter flow rate indicator	1 no of each type /rating
c)	Rate of flow controller	1 no of each type /rating
d)	Back wash filter flow rate indicator	1 no of each type /rating
e)	Differential head indicator	1 no of each type /rating
9)	**Air Blowers for Pressure Filters , Sludge pit, Gravity filters**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Impeller with shaft	1 Set
b)	All Bearings (Blower & Motor)	1 Set
c)	Gears	1 Set
d)	Filters	1 No
e)	Motor	1 Set
	Note : One set consists of quantity required for complete replacement for one blower	
10)	**Electrically Operated Hoists (For each type & capacity)**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Bearings	1 Set
b)	Rope guide	1 Set
c)	Brake lining	1 Set
	Note : One set consists of quantity required for complete replacement for one hoist of each type & capacity	
11)	**Vertical (wet pit) Pumps-(for Each Type & Size)**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Impeller with nuts & washers	1 Set of each type
b)	Bearings for Line, Head and Impeller shafts	-do-
c)	Thrust Bearings of pump & drive	-do-
d)	Wearing rings – Impeller (if applicable)	-do-
e)	Wearing rings – Casing (if applicable)	-do-
f)	Impeller Shaft, line shaft and head shaft	-do-
g)	Shaft Sleeves	-do-

h)	Stuffing box	-do-
i)	Motor with Bearings	-do-
j)	Line Shaft Couplings (if applicable)	-do-
	Note : One set consists of quantity required for complete replacement for one pump	
12)	**Horizontal Centrifugal Pumps –For Each Type & Size**	
S No.	**Name of Items**	**QUANTITY**
a)	Impeller for each type	1 Set
b)	Wearing rings – Impeller for each type (if applicable)	1 Set
c)	Wearing rings – Casing for each type (if applicable)	1 Set
d)	Shaft for each type	1 Set
e)	Shaft Sleeves for each type	1 Set
f)	Stuffing box for each type	1 Set
g)	Pump bearings for each type	1 Set
h)	Motor with bearings for each type	1 Set
	Note : One set consists of quantity required for complete replacement for one pump	
	CONTROL & INSTRUMENTATION-PT PLANT	
1.00.00	**MEASURING INSTRUMENTS**	
1)	**Electronic Transmitters**	
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model
2)	**Temperature elements**	
(i)	Temperature Transmitter	2 Nos. of each type and model
(ii)	RTD's*	1 No. of each type
(iii)	Thermo well	1 No. of each type
	* (With head assembly, terminal block and nipple) ** (to be divided into various insertion lengths in proportion to main population)	
3)	**Local Indicators (Non-Electrical type) -As applicable for the package as per the following items**	
(i)	Temperature gauges	1 No. of each range and type
(ii)	Pressure gauges	1 No. of each range and type
(iii)	Differential Pressure Gauges,	1 No. of each range and type
(iv)	Level gauges	1 No. of each range and type
(v)	Flow gauges excluding Rota meters	1 No. of each range and type
(vi)	All types of Rota meters	1 No. of each range and type.
4)	**Process Actuated Switch Devices -As applicable for this package, as per the following items**	
(i)	Temperature switches	1 No. of each range and type.
(ii)	Pressure switches	1 No. of each range and type.

(iii)	Differential Pressure switches	1 No. of each range and type.
(iv)	level switches	1 No. of each range and type
(v)	Flow switches	1 No. of each range and type
5)	**Solenoid Valves**	**2 Nos. of each type and model**
6)	**Limit Switches (for Pneumatic Valves and Manual valves)**	**2 No. of each type**
7)	**ANALYSERS**	
1	Complete Conductivity Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)	1 Set of each type
8)	**ELECTRICAL ACTUATORS**	
1	Actuators	10% or 1 No. of each type, class, size and model whichever is more.

LIST OF MANDATORY SPARES FOR CHLORINE DIOXIDE DOSING SYSTEM

Sl. No.	PARTICULARS	QUANTITY
A.	**Mechanical**	
1.	**Unloading/Transfer Pumps**	
1.1	Impeller for each type	1 Set
1.2	Wearing rings – Impeller for each type (if applicable)	1 Set
1.3	Wearing rings – Casing for each type (if applicable)	1 Set
1.4	Shaft for each type	1 Set
1.5	Shaft Sleeves for each type	1 Set
1.6	Stuffing box for each type	1 Set
1.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 Set
1.8	Pump bearings for each type	1 Set
1.9	Gland, Packing & Gland Assembly/Mechanical seal assy. for each type	1 Set
2.	**Metering/ Dosing pumps**	
2.1	Diaphragm Pump for acid/alkali injection & dosing	1 complete pump set
2.2	Diaphragms for acid/alkali injection & dosing	2 No.
3.	Relief Valves in Air Blower unit	1 No. Minimum of each type
4.	Y Strainers	1 No. Minimum of each type
5.	Fume Absorber	1 No. Minimum of each type
1.	Motor and motor bearings of each type	1 Set
2.	**Valves**	
4.1	Diaphragm Valves of All types	1 No of each type, size & rating for total population < 10 nos

		2 Nos of each type, size & rating for total population ≥ 10 nos
4.2	Diaphragms	One fourth quantity of total population
4.3	NRV (Flap type and Dual Plate Type)	Minimum 1 No. each type, size & rating
	Ball Valves of all types	Minimum 2 No. each type, size & rating
4.4	Butterfly Valves of all types	Minimum 1 No. each type, size & rating
4.5	Any other type valve	Minimum 1 No. each type, size & rating
	Agitators	
5.1	Agitator assy of each type	1 complete set
B.	**CONTROL & INSTRUMENTATION**	
1.	**Measuring Instruments**	
1.1	Electronic Transmitters	
1.1.1	Transmitters of all type, range and model No. (For the measurement of Pressure, differential pressure flow, level, temperature etc.)	2 Nos. of each type and model
1.2	Temperature elements	
1.2.1	Temperature Transmitter	2 Nos. of each type and model
1.2.2	RTD's* * (With head assembly, terminal block and nipple)	1 No. of each type
1.2.3	Thermocouples	10% of each type and length
1.2.4	Thermo well for above applications	1 No. for each type
1.3	Local Indicators (Non-Electrical type) -As applicable for the package as per the following items	
1.3.1	Temperature gauges	1 No. of each range and type
1.3.2	Pressure gauges	1 No. of each range and type
1.3.3	Differential Pressure Gauges	1 No. of each range and type
1.3.4	Level gauges	1 No. of each range and type
1.3.5	Flow gauges excluding Rota meters	1 No. of each range and type
1.3.6	All types of Rota meters	1 No. of each range and type
1.4	Process Actuated Switch Devices -As applicable for this package, as per the following items	
1.4.1	Temperature switches	1 No. of each range and type

1.4.2	Pressure switches	1 No. of each range and type
1.4.3	Differential Pressure switches	1 No. of each range and type
1.4.4	level switches	1 No. of each range and type
1.4.5	Flow switches	1 No. of each range and type
1.5	Solenoid Valves	2 Nos. of each type and model
1.6	Limit Switches (for Pneumatic Valves and Manual valves)	2 No. of each type
1.7	**ANALYSERS**	
1.7.1	Complete PH Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)	1 Set of each type
1.7.2	Complete Residual Chlorine Analyzer (including sensing unit, Electronic Transmitter unit, Prefabricated cable with connector as minimum)	1 Set of each type

LIST OF MANDATORY SPARES FOR CHP RUN OFF WTP

Sl. No.	PARTICULARS	QUANTITY
	CONTROL & INSTRUMENTATION- CHP RUN OFF WTP	
	MEASURING INSTRUMENTS	
1)	**Electronic Transmitters**	
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model
2)	**Temperature elements**	
(i)	Temperature Transmitter	2 Nos. of each type and model
(ii)	RTD's*	1 No. of each type
(iii)	Thermo well	1 No. of each type
	* (With head assembly, terminal block and nipple)	** (to be divided into various insertion lengths in proportion to main population)
3)	**Local Indicators (Non-Electrical type) -As applicable for the package as per the following items**	
(i)	Temperature gauges	1 No. of each range and type
(ii)	Pressure gauges	1 No. of each range and type
(iii)	Differential Pressure Gauges,	1 No. of each range and type
(iv)	Level gauges	1 No. of each range and type
(v)	Flow gauges excluding Rota meters	1 No. of each range and type
(vi)	All types of Rota meters	1 No. of each range and type.
4)	**Process Actuated Switch Devices -As applicable for this package, as per the following items**	
(i)	Temperature switches	1 No. of each range and type
(ii)	Pressure switches	1 No. of each range and type

(iii)	Differential Pressure switches	1 No. of each range and type
(iv)	level switches	1 No. of each range and type
(v)	Flow switches	1 No. of each range and type
5)	**Solenoid Valves**	**2 Nos. of each type and model**
6)	**Limit Switches (for Pneumatic Valves and Manual valves)**	**2 No. of each type**
	ELECTRICAL SPARES FOR CHP RUN OFF WTP	
1)	Vertical Turbine (wet pit) Pumps-Coal Decanted water pump (Clarifier Feed Pumps) motor	1 No.
2)	Supernatant Transfer Pumps motor	1 No.

LIST OF MANDATORY SPARES FOR CW TREATMENT PLANT

S. No.	ITEMS	QUANTITY
1.0	**Horizontal Centrifugal Pumps– Acid Unloading Pump**	
1.1	Impeller	1 set
1.2	Wearing rings – Impeller (if applicable)	2 sets
1.3	Wearing rings – Casing (if applicable)	2 sets
1.4	Shaft	1 set
1.5	Shaft Sleeves	2 sets
1.6	Mechanical Seal	1 set
1.7	Coupling between Pump & Drive, bushes, pins with all fasteners & coupling guards	1 set
1.8	Pump bearings	1 set
1.9	Motor with Bearings	1 set
	Note: One set consists of quantity required for complete replacement for one pump.	
2.0	**Horizontal Centrifugal Pumps– Dilution Water pumps**	
2.1	Impeller	1 set
2.2	Wearing rings – Impeller (if applicable)	2 sets
2.3	Wearing rings – Casing (if applicable)	2 sets
2.4	Shaft	1 set
2.5	Shaft Sleeves	2 sets
2.6	Stuffing box, Gland, Packing & Gland assembly	1 set
2.7	Coupling between Pump & Drive, bushes, pins with all fasteners & coupling Guards	1 set
2.8	Pump bearings	1 set
2.9	Motor with Bearings	1 set
	Note: One set consists of quantity required for complete replacement for one pump.	
3.0	**ACID DOSING PUMPS**	
3.1	Diaphragms	1 set
3.2	Coupling between Pump & Drive, bushes, pins with all fasteners & coupling guards	1 set
3.3	Pump & Motor Unit assembly	1 set
	Note: One set consists of quantity required for complete replacement for one pump of each type/ Rating	
4.0	**SCALE / CORROSION INHIBITOR DOSING PUMPS**	
4.1	Complete Pump & Motor Assembly	1 set
5.0	**DISPERSANT DOSING PUMPS**	

5.1	Complete Pump & Motor Assembly	1 set
6.0	**AGITATORS**	
6.1	Agitator Assembly with Motor & Gear Box – Scale/ corrosion preparation tank	1 set
6.2	Agitator Assembly with Motor & Gear Box – Dispersion Tank	1 set
7.0	**ANY OTHER PUMPS**	
7.1	Complete Pump & Motor Assembly	1 Set for each type of pump.
8.0	**C&I MANDATORY SPARES**	
8.1	Transmitters of all type, range and model No. (For the measurement of Pressure, differential pressure flow, level, temperature etc.) including local indication (if applicable)	2 Nos. of each type and model.
8.2	Pressure gauges	1 No. of each range and type.
8.3	Differential Pressure Gauges	1 No. of each range and type.
8.4	Level gauges	1 No. of each range and type.
8.5	Solenoid Valves	
8.6	Limit Switches (for Pneumatic Valves and Manual valves)	
8.7	Flow gauges excluding Rotameters	1 No. of each range and type.
8.8	All types of Rotameters	1 No. of each range.
8.9	**Process Actuated Switch Devices –As applicable for this package, as per the following items.**	
8.9.1	Temperature switches	1 No. of each range and type.
8.9.2	Pressure switches	1 No. of each range and type.
8.9.3	Differential Pressure switches	1 No. of each range and type.
8.9.4	level switches	1 No. of each range and type.
8.9.5	Flow switches	1 No. of each range and type.
8.8	Solenoid Valves	2 nos. of each type, model and rating.
8.9	Limit Switches (for Pneumatic Valves and Manual valves)	2 No. of each type.
8.10	**Actuator**	
8.10.1	Electronic PCB of all types	10% of each type and model
8.10.2	Absolute Encoder (replaceable part)	05% of each type and model
8.10.3	Electronic Torque Sensor	05% of each type and model

LIST OF MANDATORY SPARES FOR EFFLUENT TREATMENT PLANT

S. NO.	ITEMS	QUANTITY
1.0	**METERING / DOSING PUMPS**	
1.1	Alum Dosing Pump Unit along with motor	1 No.
1.2	Lime Dosing Pump Unit along with motor	1 No.
	Remark: One set consist of quantity required for complete replacement for one pump.	
2.0	Air Blowers for Sludge pit	
2.1	Impeller with shaft	1 set
2.2	All Bearings (Blower & Motor)	1 set
2.3	Gears	1 set
2.4	Filters	1 set

2.5	Motor	1 set
	Remark: One set consist of quantity required for complete replacement for one blower.	
3.0	**AGITATORS**	
3.1	Agitator Assembly with Motor & Gear Box – Lime Dosing tank	1 set
3.2	Agitator Assembly with Motor & Gear Box – Alum Dosing tank	1 set
3.3	Agitator Assembly with Motor & Gear Box – Flash Mixer	1 set
3.4	Agitator Assembly with Motor & Gear Box – Flocculation Tank	1 set
	Remark: One set consists of quantity required for complete replacement for one agitator.	
4.0	**ELECTRIC HOIST (For each type & capacity)**	
4.1	Bearing	1 set
4.2	Rope Guide	1 set
4.3	Brake lining	1 set
	Remark: One Set consists of quantity required for complete replacement of one hoist of each type and capacity	
5.0	**ETP System**	
5.1	Pack of Lamella Clarifier/ Tube Settler	1 set
5.2	Oil Skimmer (WSWS)	1 set
	Remark: 1) One set of Pack of Lamella Clarifier consists of quantity required for complete replacement for one Lamella Clarifier/ Tube Settler. 2) One set of Pack of Oil Skimmer consists of quantity required for complete replacement for Oil skimmer in WSWS.	
6.0	**MOTOR**	
6.1	Waste Service water transfer pump motor	1 No.
6.2	Central Monitoring Basin Transfer Pump motor	1 No.
7.0	**ELECTRICAL ACTUATORS**	
7.1	Actuators	10% or 1 no. of each type, class, size and model whichever is more.
	One set consists of quantity required for complete replacement for one motor.	
	CONTROL & INSTRUMENTATION- ETP	
1)	**Electronic Transmitters**	
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model
2)	**Temperature elements [*** (With head assembly, terminal block and nipple) ** (to be divided into various insertion lengths in proportion to main population)]	
(i)	Temperature Transmitter	2 Nos. of each type and model
(ii)	RTD's*	1 no. of each type
(iii)	Thermo well	1 no. of each type
3)	**Local Indicators (Non-Electrical type) -As**	

	applicable for the package as per the following items	
(i)	Temperature gauges	1 no. of each range and type
(ii)	Pressure gauges	1 no. of each range and type
(iii)	Differential Pressure Gauges,	1 no. of each range and type
(iv)	Level gauges	1 no. of each range and type
(v)	Flow gauges excluding Rota meters	1 no. of each range and type
(vi)	All types of Rota meters	1 no. of each range and type.
4)	**Process Actuated Switch Devices -As applicable for this package, as per the following items**	
(i)	Temperature switches	1 no. of each range and type
(ii)	Pressure switches	1 no. of each range and type
(iii)	Differential Pressure switches	1 no. of each range and type
(iv)	level switches	1 no. of each range and type
(v)	Flow switches	1 no. of each range and type
5)	Solenoid Valves	2 Nos. of each type, model and rating
6)	Limit Switches (for Pneumatic Valves and Manual valves)	2 no. of each type

LIST OF MANDATORY SPARES FOR CONDENSATE POLISHING UNIT

S. No.	ITEMS	QUANTITY
1.00.00	**CONDENSATE POLISHING UNIT (CPU)**	
	Mandatory spares of CPU/Regeneration Area -Mechanical	
1	Nozzles & Strainers for Service Vessel	1 Set of required qty for one vessel
	CPU Regeneration Area	
1	Nozzles/Strainers for Regeneration area Vessels	One fourth of required quantity of one vessel
2	Bottom Consep for ARU/CRU	1 no
	CPU/Regen Area Blowers	
1	Impeller with lock nuts and washers	1 Set
2	Air Filters	2 No.
3	Bearings for drive & driven	1 Set
4	Gears (if applicable)	1 Set
5	V-belts	1 Set for each drive
	CPU/ Regen Area Pumps including N-pit & Backwash	
1	Impeller for each type	1 Set
2	Wearing rings – Impeller for each type (if applicable)	1 Set
3	Wearing rings – Casing for each type (if applicable)	1 Set
4	Shaft for each type	1 Set
5	Shaft Sleeves for each type	1 Set
6	Stuffing box for each type (if applicable)	1 Set
7	Pump bearings for each type	1 Set

8	Gland Packing & Gland Assembly/Mechanical seal assy. for each type (as applicable)	1 Set
9	Diaphragm Pump for acid/alkali injection & dosing	1 complete pump set
10	Diaphragms for acid/alkali injection & dosing	Minimum 2 No. each type, size & rating
11	Strainers in pipelines	Minimum1 No. each type, size & rating
12	Relief Valves in Air Blowers unit	Minimum 1 No. each type, size & rating
	CPU/Regen Area Valves	
1	Diaphragm Valves of All types	1 no of each type, size & rating for total population < 10 nos 2 nos of each type, size & rating for total population ≥ 10 nos
2	Diaphragms	One fourth quantity of total population
3	NRV (Flap type and Dual Plate Type)	Minimum 1 No. each type, size & rating
4	Ball Valves of all types	Minimum 1 No. each type, size & rating
5	Butterfly Valves of all types	Minimum 1 No. each type, size & rating
6	Any other type valve	Minimum 1 No. each type, size & rating
	Agitators	
1	Agitator assy. With motor and gear box - Alkali Preparation Tank	1 complete set
2	Agitator assy. With motor and gear box - Alkali Day Tank	1 complete set
3	Agitator assy. With motor and gear box - Lime Tank near N-pit	1 complete set
4	Any other agitator assembly with motor & gear box (if applicable)	1 complete set
	CONTROL & INSTRUMENTATION –CPU	
1.00.00	MEASURING INSTRUMENTS	
1)	Electronic Transmitters	
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	10 % or 1 No. of each type and model whichever is more
2)	Temperature elements	
(i)	Temperature Transmitter	10 % or 1 No. of each type and model whichever is more
(ii)	RTD's*	1 No. of each type
(iii)	Thermo well**	1 No. of each type
	* (With head assembly, terminal block and nipple)	
	** (to be divided into various insertion lengths in proportion to main population)	

3)	**Local Indicators (Non-Electrical type) - As applicable for the package as per the following items**	
(i)	Temperature gauges	1 No. of each range and type
(ii)	Pressure gauges	1 No. of each range and type
(iii)	Differential Pressure Gauges,	1 No. of each range and type
(iv)	Level gauges	1 No. of each range and type
(v)	Flow gauges excluding Rota meters	1 No. of each range and type
(vi)	All types of Rota meters	1 No. of each range and type
4)	**Process Actuated Switch Devices -As applicable for this package, as per the following items**	
(i)	Temperature switches	1 No. of each range and type
(ii)	Pressure switches	1 No. of each range and type
(iii)	Differential Pressure switches	1 No. of each range and type
(iv)	level switches	1 No. of each range and type
(v)	Flow switches	1 No. of each range and type
5)	Solenoid Valves	10 % or 1 No. of each type and model whichever is more
6)	Limit Switches (for Pneumatic Valves and Manual valves)	2 No. of each type
7)	**ANALYSERS**	
1)	Complete PH Analyzer (including Flow through type cell and electrode, Electronic transmitter unit, Pre-fabricated cable with connector as minimum)	1 Set of each type
2)	Complete Conductivity Analyzer (including Flow through type cell and Electrode, electronic Transmitter unit, Prefabricated cable with connector as minimum)	1 Set of each type
3)	Complete Silica Analyzer (including sensing unit, Electronic Transmitter unit, Pre-fabricated cable with connector Rubber Tubes & Capillary Tubes, solenoid valves, as minimum) along with sample sequencing unit	1 Set of each type
4	Dissolved O2 Analysers (including sensing unit, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum) (if applicable)	1 Set of each type
Note	Reagents for analyzers of DM/ CPU systems should be supplied at the time of commissioning of the analyzers.	
2.00.00	NOT USED	
3.00.00	**CONTROL VALVES, ACTUATORS AND ACCESSORIES**	
1	Pneumatic and electro-hydraulic actuator assembly	1 No. of each type, model and rating.
2	Diaphragms, O' rings, seals etc. of all types make etc.	5 Nos.
3	Solenoid valves (if applicable)	2 nos.
4	Positioner units /smart positioners (complete unit) & accessories (link assembly)	1 No.

5	Pneumatic air-filter/Regulator of each type, make rating etc.	2 Nos.
6	Air lock relays	2 nos. of each type
3.00.01	PNEUMATICALLY OPERATED ISOLATION / BLOCK VALVES, ACTUATORS & ACCESSORIES (For all ON/OFF valves supplied under this package even if one or more of these items are also specified elsewhere under mandatory spares)	
1	Pneumatic actuator assembly.	1 No. of each type, model and rating.
2	Diaphragms, O' rings, seals etc. of all types make etc.	5 Nos.
3	Limit switches (complete unit) & accessories (link assembly)	2 nos.
4	Pneumatic air-filter/Regulator of each type, make rating etc.	2 nos.
	ELECTRICAL SPARES –CPU	
	Motors	
a)	DM Water Regeneration Pumps motor and motor bearing	1 No.
b)	Alkali Transfer cum Recirculation Pump motor and motor bearing	1 No.
c)	Waste recirculation cum Disposal Pumps (Pre Filter waste & DM Waste water Pump) motor and motor bearing	1 No.

LIST OF MANDATORY SPARES FOR DM PLANT

	DEMINERALISATION PLANT		
Sl. No.	**Name of Items**	**Unit**	**QUANTITY**
1)	**ACTIVATED CARBON FILTER**		
a)	Strainers for activated (of DM Stream) carbon filters or Header lateral	No / Set	Min.100 nos. or 1 Set whichever is more
b)	Activated Carbon filter media (for both DM stream & alkali filter application)	%	1.1 times of One AC filter (110%)
	Note: One set consists of quantity required for complete replacement for one AC filter of each type /application as the case may be.		
2)	**CATION EXCHANGERS**		
a)	Middle collector assembly for each stream of MSRL (In case of counter current regeneration system)	No	1 Nos for each DM Stream
b)	Strong Acid Cation resin	---	1.1 times of one full charge of one cation vessel (110%)
c)	Weak Acid Cation resin	---	1.1 times of one full charge of one cation vessel (110%)

d)	Strainers for Strong Acid Cation Exchanger or Header lateral	No / Set	Min.100 nos. or 1 Set whichever is more
e)	Strainers for Weak Acid Cation Exchanger or Header lateral (if applicable)	No / Set	Min.100 nos. or 1 Set whichever is more
3)	**ANION EXCHANGERS**		
a)	Middle collector assembly. for each stream of MSRL (In case of counter current regeneration system)	No	1 Nos for each DM Stream
b)	Weak Base Anion resin	---	1.1 times of One (1) full charge of One (1) Anion vessel (110%)
c)	Strong Base Anion resin	---	1.1 times of One (1) full charge of One (1) Anion vessel (110%)
d)	Strainers for Strong Base Anion Exchanger or Header lateral	No / Set	Min.100 nos. or 1 Set whichever is more
4)	**MIXED BED EXCHANGERS**		
a)	Middle collector assembly for Mixed Bed	No	1 Nos for each DM Stream
b)	Strong Acid Cation resin	---	1.1 times of One (1) full charge of One (1) Mixed bed vessel (110%)
c)	Strong Base Anion resin	---	1.1 times of One (1) full charge of One (1) Mixed bed vessel (110%)
d)	Strainers for MB exchanger or Header lateral	No / Set	Min. 50 nos. or 1 Set whichever is more
5)	**VALVES (DM PLANT)**		
a)	Manual Diaphragm valves and Pneumatic operated diaphragm valves with actuators	LOT	1 no. of each type, size & rating for total population < 10 nos. 2 nos. of each type, size & rating for total population >=10 nos.
b)	Diaphragm for above valves	LOT	1 no. of each type, size & rating for total population < 10 nos. 2 nos. of each type, size & rating for total population >=10 nos.
c)	Butterfly Valves (manual and pneumatic operated valves with actuators)	LOT	1 no. of each type, size & rating for total population < 10 nos. 2 nos. of each type, size & rating for total population >=10 nos.

d)	Check Valves /Non-return Valve	LOT	1 no. of each type, size & rating for total population < 10 nos. 2 nos. of each type, size & rating for total population>= 10 nos.
e)	Gate Valves	LOT	1 no. of each type, size & rating for total population < 10 nos. 2 nos. of each type, size & rating for total population >=10 nos.
6)	**Horizontal Centrifugal Pumps – (For Each Type & Size)**		
a)	Impeller	Set	1
b)	Wearing rings – Impeller (if applicable)	Set	1
c)	Wearing rings – Casing (if applicable)	Set	1
d)	Shaft	Set	1
e)	Shaft Sleeves	Set	1
f)	Mechanical Seal	Set	1
g)	Pump bearings	Set	1
h)	Motor with Bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump		
7)	**DEGASSER BLOWERS, MIXED BED BLOWERS**		
a)	Impeller with lock nuts & washers	Set	1
b)	Shaft	Set	1
c)	Bearings of Blowers	Set	1
d)	Suction filter Assembly	Set	2
e)	Motor with Bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one blower of each type /Rating		
8)	**Agitators**		
a)	Agitator Assembly with Motor and Gear Box – Alkali Preparation Tank	Set	1
b)	Agitator Assembly with Motor and Gear Box – Alkali Day Tank	Set	1
c)	Agitator Assembly with Motor and Motor and Gear Box – Lime Tank near N.Pit	Set	1
d)	Agitator Assembly with Motor and Gear Box – Brine Preparation tank	Set	1
9)	DOSING EJECTORS	QTY	QTY
		For Acid application	For Alkali application
a)	Complete Ejector Assembly	1 Set	1 Set
	Note: One set consists of quantity required for complete replacement for one ejector of each type & capacity		

	CONTROL & INSTRUMENTATION-DM PLANT		
1.00.00	**MEASURING INSTRUMENTS**		
1)	Electronic Transmitters		
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)		2 Nos. of each type and model
2)	Temperature elements [* (With head assembly, terminal block and nipple) ** (to be divided into various insertion lengths in proportion to main population)]		
(i)	Temperature Transmitter		2 Nos. of each type and model
(ii)	RTD's*		1 no. of each type
(iii)	Thermo well		1 no. of each type
3)	Local Indicators (Non-Electrical type) -As applicable for the package as per the following items		
(i)	Temperature gauges		1 no. of each range and type
(ii)	Pressure gauges		1 no. of each range and type
(iii)	Differential Pressure Gauges,		1 no. of each range and type
(iv)	Level gauges		1 no. of each range and type
(v)	Flow gauges excluding Rota meters		1 no. of each range and type
(vi)	All types of Rota meters		1 no. of each range and type.
4)	Process Actuated Switch Devices -As applicable for this package, as per the following items		
(i)	Temperature switches		1 no. of each range and type
(ii)	Pressure switches		1 no. of each range and type
(iii)	Differential Pressure switches		1 no. of each range and type
(iv)	level switches		1 no. of each range and type.
(v)	Flow switches		1 no. of each range and type
5)	Solenoid Valves		2 nos. of each type and model
6)	Limit Switches (for Pneumatic Valves and Manual valves)		2 nos. of each type
7)	**ANALYSERS**		

1	Complete PH Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
2	Complete Conductivity Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
3	Complete Turbidity Analyzer (including sensing unit, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
4	Complete Residual Chlorine Analyzer (including sensing unit, Electronic Transmitter unit, Prefabricated cable with connector as minimum)		1 Set of each type
2.00.00	CONTROL VALVES, ACTUATORS AND ACCESSORIES		
2.01.00	Control valve Smart Positioner Unit		1 No. of each type
2.02.00	**REVERSE OSMOSIS SYSTEM (AS APPLICABLE)**		
1)	**Coagulant Unloading cum Transfer Pumps**		
b)	Impeller with nuts & other accessories	Set	1
c)	Wearing rings (Impeller & Casing; as applicable)	Set	1
d)	Shaft	Set	1
e)	Shaft Sleeves	Set	1
f)	Pump bearings	Set	1
g)	Mechanical Seal	Set	1
h)	Motor with bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump.		
2)	**Coagulant Aid, Coagulant Dosing Pumps**		
a)	Diaphragm	Set	2
b)	Connecting Rod with nuts & bolts	Set	1
c)	Worm & worm wheel	Set	1
d)	All pump Bearings including Cross head guide Bearings	Set	1
e)	Motor with bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump.		
3)	**UF (Ultrafiltration) Plant – Membranes [For RO (DM)]**		
a)	UF Membranes	LOT	10% of total installed membranes in all streams /trains
4)	**Horizontal Centrifugal Pumps for DM-RO (For Each Type & Size)**		
a)	Impeller with nuts & other accessories	Set	1
b)	Wearing rings (Impeller & Casing; as applicable)	Set	1

c)	Shaft	Set	1
d)	Shaft Sleeves	Set	1
e)	Motor with bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump.		
5)	**Cartridge Filtration Units [For RO (DM)]**		
a)	Cartridge Filters Elements	LOT	30% of total installed membranes in all the three streams/trains
6)	**RO (Reverses Osmosis) Plant – Membranes [For RO (DM)]**		
a)	RO Membranes	LOT	10% of total installed membranes in all streams / trains
7)	**Agitators**		
a)	Agitator Assembly – for all chemical tanks as applicable (RO)	Set	1
8)	Chemical Cleaning System (RO Plant)		
a)	Mixer (Agitator) of Chemical Tanks	No	1
b)	Chemical Cleaning Pump with Motor	No	1
c)	Cartridge Filter Element	Set	1
9)	Chemical Cleaning System (UF membranes) [For RO (DM)]		
a)	Mixer (Agitator) of Chemical Tanks	No	1
b)	Chemical Cleaning Pump with Motor	No	1
c)	Cartridge Filter Element	Set	1
10)	Flushing Cleaning System (RO Plant)		
a)	Flushing Pump with Motor	No	1
2.03.00	CHEMICAL STORAGE & DOSING SYSTEM		
B-1)	Anti-Scalant Dosing Pumps, Anti-Oxidant Dosing Pumps		
a)	Dosing Pump with Motor unit of each type / size	No	1
	Note: One set consists of quantity required for complete replacement for one pump.		
B-2)	Horizontal Centrifugal Pumps (For Each Type & Size)		
a)	Impeller with nuts & other accessories	Set	1
b)	Wearing rings (Impeller & Casing; as applicable)	Set	1
c)	Shaft	Set	1
d)	Shaft Sleeves	Set	1
e)	Pump bearings	Set	1
f)	Mechanical Seal	Set	1
g)	Motor with bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump.		
B-3)	Dosing (Metering) Pumps (For Each Type & Size)		

a)	Dosing Pump unit with motor of each type / size	No	1
C)	Valves for RO & UF -**The mandatory spares shall be as indicated under DM plant**		
a)	Cartridge Filter Element	Set	1
10)	Flushing Cleaning System (RO Plant)		
a)	Flushing Pump with motor	No	1
B-1)	Anti-Scalant Dosing Pumps, Anti-Oxidant Dosing Pumps		
a)	Dosing Pump unit with motor of each type / size	No	1
	Note: One set consists of quantity required for complete replacement for one pump.		
B-2)	Horizontal Centrifugal Pumps (For Each Type & Size)		
a)	Impeller with nuts & other accessories	Set	1
b)	Wearing rings (Impeller & Casing; as applicable)	Set	1
c)	Shaft	Set	1
d)	Shaft Sleeves	Set	1
e)	Pump bearings	Set	1
f)	Mechanical Seal	Set	1
g)	Motor with bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump.		
B-3)	Dosing (Metering) Pumps (For Each Type & Size)		
a)	Dosing Pump unit of each type / size	No	1
b)	Motor with bearings	Set	1
	CONTROL & INSTRUMENTATION- (Chemical storage, dosing & RO based DM plant)		
1.00.00	**MEASURING INSTRUMENTS**		
1)	Electronic Transmitters		
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)		2 Nos. of each type and model
2)	Temperature elements [* (With head assembly, terminal block and nipple) ** (to be divided into various insertion lengths in proportion to main population)]		
(i)	Temperature Transmitter		2 Nos. of each type and model
(ii)	RTD's*		1 no. of each type
(iii)	Thermo well		1 no. of each type
3)	Local Indicators (Non-Electrical type) -As applicable for the package as per the following items		

(i)	Temperature gauges		1 no. of each range and type
(ii)	Pressure gauges		1 no. of each range and type
(iii)	Differential Pressure Gauges,		1 no. of each range and type
(iv)	Level gauges		1 no. of each range and type
(v)	Flow gauges excluding Rota meters		1 no. of each range and type
(vi)	All types of Rota meters		1 no. of each range and type.
4)	Process Actuated Switch Devices -As applicable for this package, as per the following items		
(i)	Temperature switches		1 no. of each range and type
(ii)	Pressure switches		1 no. of each range and type.
(iii)	Differential Pressure switches		1 no. of each range and type.
(iv)	level switches		1 no. of each range and type.
(v)	Flow switches		1 no. of each range and type.
5)	Solenoid Valves		2 Nos. of each type and model
6)	Limit Switches (for Pneumatic Valves and Manual valves)		2 no. of each type
7)	**ANALYSERS**		
1)	Complete PH Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
2)	Complete Conductivity Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
3)	Complete Turbidity Analyzer (including sensing unit, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
4)	Complete Residual Chlorine Analyzer (including sensing unit, Electronic Transmitter unit, Prefabricated cable with connector as minimum)		1 Set of each type
	ELECTRICAL ACTUATORS (Applicable for Resin based Dm plant & RO based DM plant both)		

1.00.00	Name of Items	Unit	QUANTITY
1)	Actuators		10% or 1 no. of each type, class, size and model whichever is more.

LIST OF MANDATORY SPARES FOR LIME DOSING SYSTEM

Sl. No.	PARTICULARS	QUANTITY
1	Valves all sizes (Population= All Units)	5% of the total population of each type, size, and class OR minimum 2 nos. of each type size & class whichever is more
2.	Transmitters of all type, range and model No. (For the measurement of Pressure, differential pressure flow, level, temperature etc.)	10% of specified quantity or minimum 2 nos. of each model
3.	PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING / TUBING AS APPLICABLE)	
3.1	Valves of all types and models	20 Nos. of each type and model
3.2	2 way, 3way, 5way valve manifolds	10 Nos. of each type, class, size and model
3.3	Fittings	100 Nos. of each type
3.4	Purge meters	20 nos. of each type and model
3.5	Filter regulators	20 nos. of each type and model
3.6	**ELECTRICAL ACTUATORS**	
3.6.1	Actuators	1 No. of each type and rating
3.6.2	Power unit for modulating actuator	2 nos. of each type
3.6.3	DC-DC unit / Power Units	2 nos. of each type
3.6.4	Electronic cards	2 nos. of each type
3.6.5	Position feedback transmitters (if applicable)	2 nos. of each type
3.6.6	Control Unit	2 nos. of each type
3.6.7	Torque and limit switch assembly of each unit (as applicable)	2 nos. of each type
3.6.8	Electronic PCB of all types	10% of each type & model
3.6.9	Absolute Encoder (replaceable part)	5% of each type & model
3.6.10	Electronic Torque sensor	5% of each type & model

ANNEXURE-VII

FORMAT FOR OPERATION AND MAINTENANCE

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	**Cover page**				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX, email address, Emergency Contact number				
1.5	Name and sign of prepared by, checked by & approved by				
1.6	Revision history with approval Details				
2.0	**Index**				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	**Description of Plant/System**				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system, operating conditions, performance parameters under normal, start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings, Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	**Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)**				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	**Operation Guidelines for plant personal/user/operator**				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipment along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipment.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting				

	values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair, Testing and calibration procedures				
6.0	**Maintenance guidelines for plant personal**				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres, Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

ANNEXURE VIII

PACKING PROCEDURE

DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/ Assemblies/ Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments. For Seaworthy Packing refer standard AA0490004 wherever applicable.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this product standard, must appear in the Shipping list/Packing List.

2 SCOPE:

This procedure gives minimum guidelines to be complied with for domestic packing of Components /Assemblies/ Equipment. This domestic packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage of materials.

3 WOOD SPECIFICATION

Based on availability, the wood shall conform to specification AA51401 or AA51402.

4 TYPES OF PACKING:

The following 5 types of packing have been standardized for packing of General Components/ Assemblies.

1) **'OP'** - Open Type.
2) **'PP'** - Partially Packed.
3) **'CP'** – Crate/Box Packing - Components/Equipment requiring physical protection.
4) '**CQ**' - Case Packing – Machined components-Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
5) '**CR**' - Case Packing – Electrical/Electronic Components/ Assemblies, which require special packing viz. Water Proof, Shock Proof etc…

5 DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

5.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

5.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene

Film to Specification No. AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

5.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

5.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required. This may be prescribed for electronic parts/critical machined components/surfaces.

For mechanical product like valves where motors are separately securely wrapped in polyethylene, the requirement of individual component wrapping shall be exempted.

5.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel to AA55619 packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420 before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board, meeting requirements of AA51414 .

6 PREPARATION OF PACKING CASES

6.1 DIMENSIONS:

a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm as per applicable drawings of the respective units.

b) Width of all planks including the tongue shall be more than 125mm and after plaining it shall be minimum 100mm.

c) Minimum number of planks shall be used for a shook.

d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel.

e) Width of binding planks shall be minimum 100mm.

f) Distance between any 2 binding planks shall be less than 750mm.

g) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm

h) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.

i) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

6.2 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

6.3 TONGUE AND GROOVE JOINTS

Two consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

6.4 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shook's. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

6.5 OTHER MATERIALS

6.5.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

6.5.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

6.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust.If sufficient nailing is done for bigger boxes, strapping need not be done.

6.5.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

6.5.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

6.5.6 FASTENERS

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

6.5.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

6.5.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

6.5.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

6.5.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Size of the marking plate shall be maintained minimum of size as per the details specified in the Figure 4.

6.5.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

6.5.12 SILICA GEL:

This shall be of indicating type to conform to IS: 3401/AA55619.Silical gel shall be used for such products only where moisture needs to be avoided.

6.5.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME	PLACE-PINCODE
SILICA GEL	INDICATING TYPE
BLUE :	ACTIVE
ROSE :	REDUCED ACTIVITY
WHITE :	NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

6.5.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

6.5.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

6.5.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).

6.5.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

6.5.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

6.5.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

1) Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
2) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
3) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
4) Direction sticker “Front” & “Back” - 4 nos. Size 2.0Cm x 0.75Cm
5) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
6) "Fragile” sticker: 2 Nos. Size. 2.1Cm x 1.5Cm
7) "DO NOT STACK” sticker - 2 Nos. Size 3.0Cm x 2.2Cm

In place of stickers, writing all the details legibly with paint shall be allowed & respective units may take decision accordingly.

7 PACKING OF CUBICLES:

7.1 The packing is to be done as per clause 5 in all respects.

7.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

7.3 The cubicles will be of different sizes both width wise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm.The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

7.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shook's shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7) using blue nails (as per 6.5.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 6.5.7).

7.5 SILICA GEL:

Silica gel (as per 6.5.12) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 6.5.13).

7.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

7.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

7.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 6.5.8) with distance between consecutive layers less than 500mm.

7.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 6.5.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

7.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 6.5.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 6.5.11) shall be nailed to front / rear of case.

7.11 MARKING PLATE:

One no. (As per 6.5.10) shall be nailed to the front side of the case.

7.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

7.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

7.14 PACKING OF CUBICLES FOR EXPORT

Refer Corporate Standard AA0490009.

8 PACKING OF LOOSE ITEMS/SPARES

1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
2) Wood shall conform to specification AA51401 or AA51402 with Tongue and Groove joint as per clause 6.3.
3) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
4) External surface of planks on front and rear shall be plane 100% (except bottom plank).
5) Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 6.5.7) using blue nails.
6) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
7) Internal packing: Items that go into the box shall be packed using 100GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.
8) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.
9) Silica gel as per clause 6.5.12 held in cotton bags as per clause 6.5.13 shall be kept at proper places in the box.
10) Packing slip kept in polyethylene bag (clause 6.5.16) shall be placed in the box.
11) Marking plate as per clause 6.5.10 shall be nailed to side of the box.
12) Two numbers of hoop iron strips as per clause 6.5.3 shall be strapped tightly on the case using clips.
13) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
14) Loose items to be kept inside the cubicle

- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.

- Other items which are given loose in addition to cubicle shall be packed in separate boxes.

9 BOX SIZES

9.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

SNO	BOX TYPE	BOX SIZE (in mm)	BOX Wt (in KG)	Carrying Capacity
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	

Table 2 – WOODEN BOX DETAILS

BOX TYPE	BOX SIZE (in MM)	BOX Wt (in KG)	Carrying Capacity
1	320X250X260	10	
2	320X250X430	15	
3	430X370X430	25	
4	670X670X470	65	
5	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
9	1300X770X1050	155	
10	2500X850X800	225	
11	2000X1500X1200	305	
12	1850X1050X1250	260	
13	2000X800X800	180	
14	2600X1500X1600	470	
15	250X250X600	20	
16	250X250X880	30	
17	300X300X700	25	
18	380X380X880	45	
19	510X510X1400	60	
20	570X570X1400	80	
21	575X575X1875	105	
22	3600X1100X1100	390	
23	900X500X800	110	
24	2000X950X740	225	
25	1600X1120X700	220	
26	2500X2000X1200	490	
27	2900X1900X1400	525	
28	3000X1000X900	370	
29	3200X2200X950	450	
30	2150X1100X750	325	
31	2000X2000X700	130	
32	700X1200X1325	130	

Table 3 – STEEL BOXES

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
1	I	2480	1680	1500	339	4500
2	II	1200	900	600	061	2000
3	IIB	1800	850	950	115	2500
4	III	900	600	600	029	1000
5	IV	600	450	500	019	750
6	V	400	350	300	011	500

TYPICAL PATTERN OF WOODEN BOX

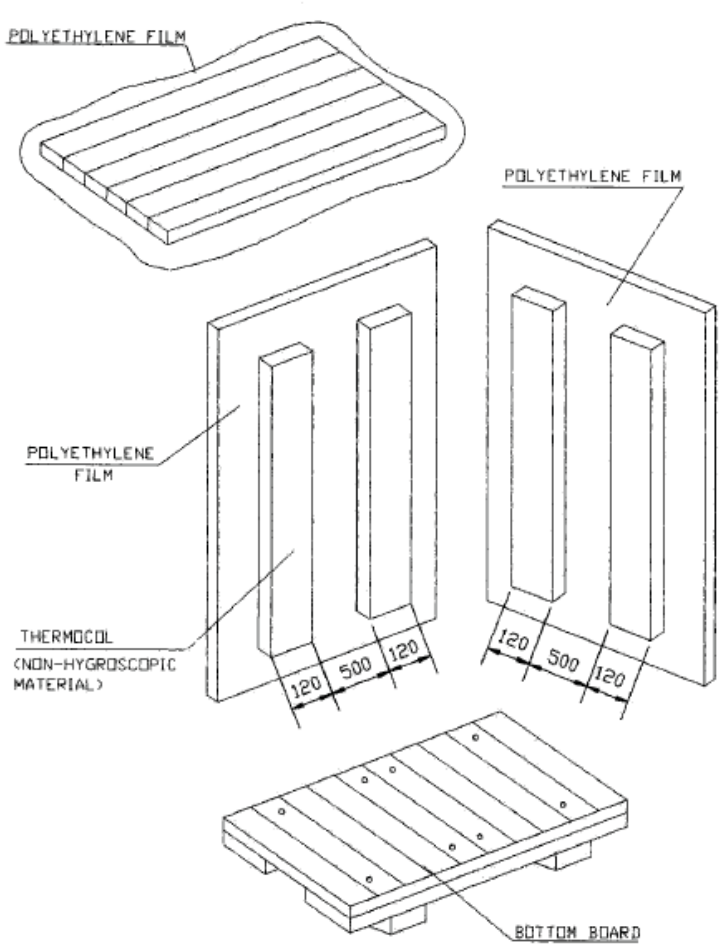


Figure 1

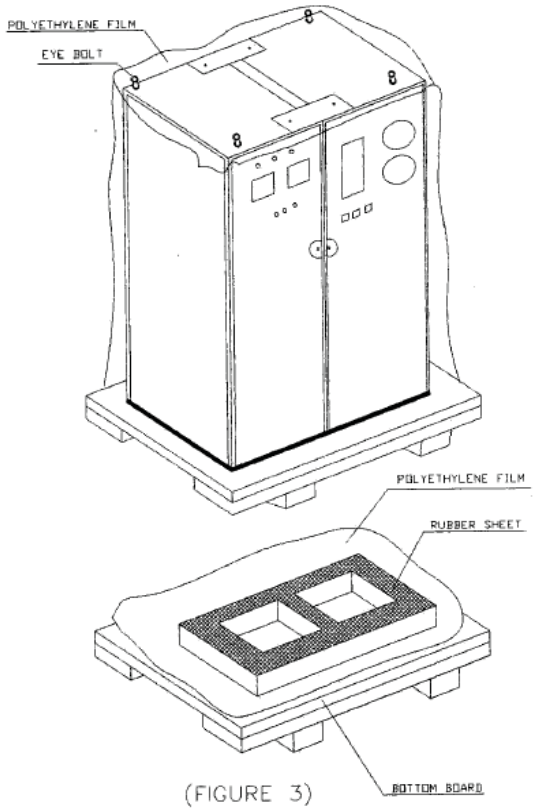


Figure 2

9.2 STEEL CONTAINERS:

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections. Depends on the availability of resources & requirements units may be allowed to use standard cargo containers also instead of fabricated steel boxes.

a) Following precautions are to be taken during packing: -

b) Put the machine in the steel container properly,

c) Cover the machine with polythene.

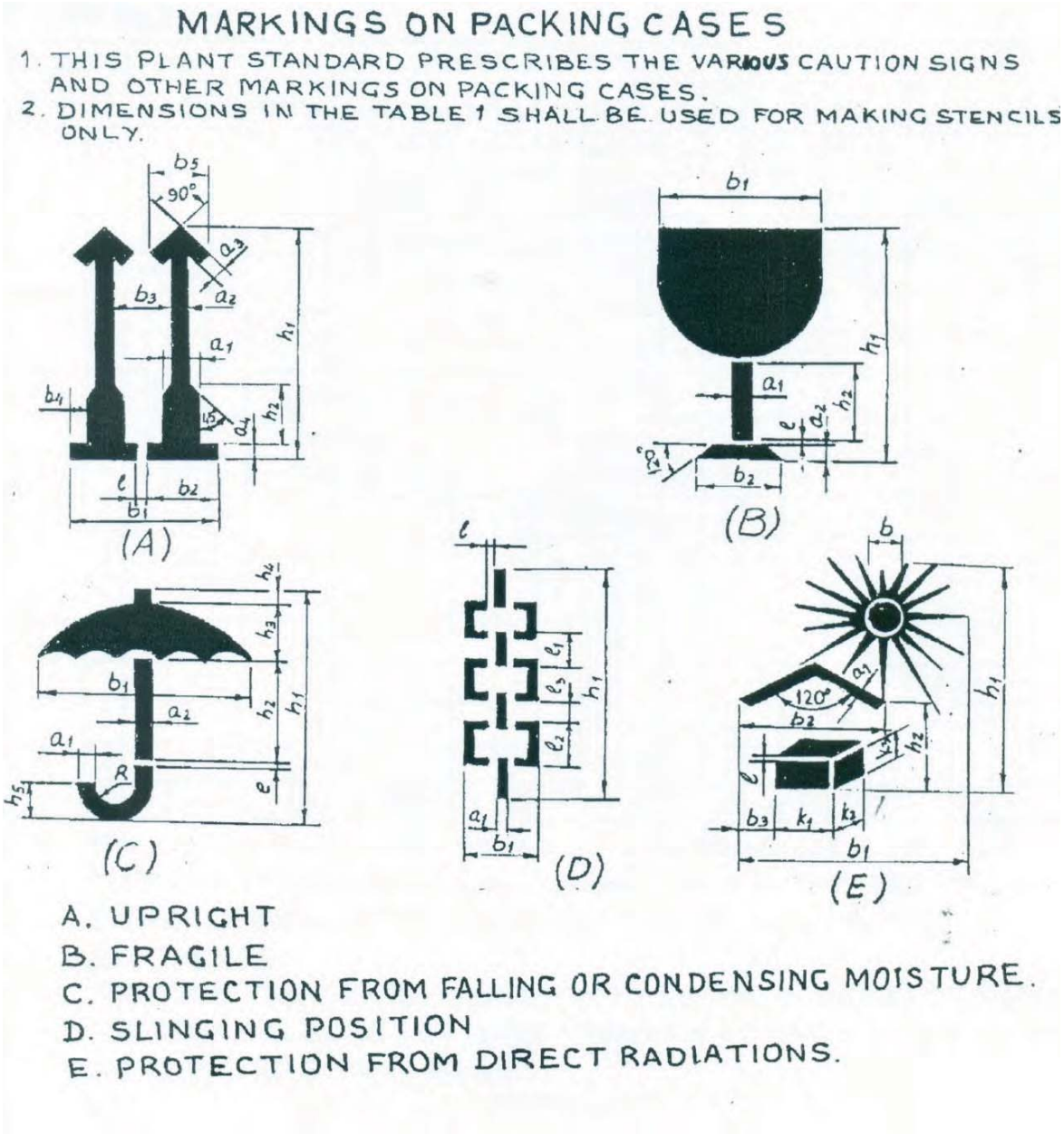
d) To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.

e) Put cover on steel, container and Bolt Properly

9.3 SEALED PACKING:

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture. The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

10 MARKINGS/STENCILINGS



Center of Gravity

Figure 3

DESIGN-ATION		DIMENSION IN MM																						
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R
A	1	12	5	5	4	52	25	19	8	21		2	84	23										
	2	17	7	7	6	75	36	29	11	30		3	119	33										
	3	24	10	10	8	104	50	38	16	42		4	168	46										
	4	34	14	14	11	147	71	59	23	60		5	239	65										
B	1	5	5			50	33					2	84	25										
	2	7	7			71	47					3	119	36										
	3	10	10			100	66					4	168	50										
	4	14	14			142	94					5	239	71										
C	1	4	3			66						2	80	39	19	5	11							6
	2	6	4			85						3	114	55	27	7	16							9
	3	8	6			120						4	160	78	38	10	22							12
	4	11	9			170						5	227	110	54	14	31							17
D	1	6				30						4	148								30	30	10	
	2	9				42						5	209								42	42	14	
E	1	3				69	47	10			16	2	91	26				17	8	11				
	2	4				98	67	15			23	3	128	33				24	11	16				
	3	6				138	94	20			32	4	182	62				34	16	22				

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel(AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

	BHEL – <unit> - <location> - <pin>				
CONSIGNEE					
MATERIAL					
CUSTOMER REF.			MO. NO.		
DESPATCH ADVICE NOTE NO			CASE NO		
DIMENSIONS(MM) L x B x H				NET WT –KGS	GROSS WT –KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE - KEEP DRY DO NOT DROP - DO NOT TILT				

Figure 4 – TYPICAL MARKING PLATE (225 X 170)

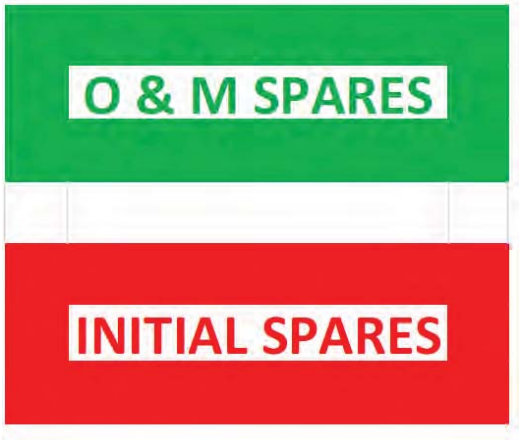


Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

11 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

– To utilize useable wood of incoming packing cases, for manufacturing of new packing boxes.
– To recycle incoming wooden packing cases, as such, wherever possible.

1) All incoming wooden packing cases received from suppliers /customers will be opened carefully, with the intention of reusing them, by Shop.
2) After carefully taking out the contents, the empty wooden packing cases will be shifted by Shop to the specified locations i.e. bin / nearly spaces, already earmarked in stores.
3) Material shifting contractor engaged by store, will collect all such wooden packing cases and scrap wood from specified points, on a regular basis.
4) After collecting / loading the empty packing cases/ scrap wood, contractor will take the carrier first to Weighment Bridge for weighment, thereafter; he will go to Carpentry, where Carpentry representative will identify the packing cases which can be used by Carpentry for manufacturing of New Packing Boxes. All such identified packing boxes will be unloaded and handed over to Carpentry by contractor.
5) These packing boxes will be made re-useable after necessary rectification and additional work.
6) Contractor will again take the carrier for weighment and this second reading will also be recorded on the same “Weighment Slip”.
7) Weight of empty packing cases / scrap wood taken will be calculated on the basis of 1st and 2nd weighment readings recorded on the “Weighment Slip”. A copy of“Weighment Slip” (where both the weighment readings are recorded) will be given by the contractor to the carpentry representative. Based on this “Weighment Slip”, carpentry will maintain a register in which details of quantity received will be recorded.
8) All “Weighment Slips” will invariably be signed by carpentry representative (even when no boxes have been unloaded by carpentry). Store will accept the scrap wood only if “Weighment Slips” are signed by carpentry representative.
9) Balance empty packing cases / scrap wood will be handed over by contractor to Store, for storing in scrap yard.
10) A separate area in Scrap yard will be provided, for executing the work of denailing of wooden packing cases, under supervision of carpentry.
11) Carpentry contractor will identify packing cases / scrap wood for denailing, which will behanded over to him by Store, at Scrap yard, for denailing and further operation.
12) Quality and Carpentry will jointly inspect the wood generated by de-nailing process and will prepare “INSPECTION CUM RECEIPT REPORT OF USEABLE WOOD RECEIVED FROM TPS – STORE BY CARPENTRY”.
13) After acceptance of the wood by Quality and Carpentry, the same will be shifted to carpentry for receipt and its record will be maintained by carpentry.
14) This will be a Permanent Productivity Project executed by carpentry. “Productivity Savings “duly verified at the current Purchase Order rate of wood, will be sent every month to Resource Management Department, for highlighting it in their monthly progress report.

12 STANDARD METHOD OF PACKING

Table 5 - Standard Method of Packing

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
PRESSUE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			
GASKETS	O							
FASTENERS	O							
COVERS		O						
EXCHANGERS								

CORPORATE STANDARD

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
AIR BOTTLES	O							
TITANIUM BOTTLE	O							
WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							
BOILER DRUMS					O			
BOILER ITEMS								
COILS			O					
PANELS					O			
HEADERS			O		O			
FEEDERS								
MACHINED ITEMS								
SHELL SEGMENTS					O			

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
SHELL SEGMENTS IN STACKS					O			
SPHERE PETALS								
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					O			
ROLLERS	O							
VALVE TRAYS								
VALVE TRAY COMPONENTS	O							
LATTICE GIRDERS		O						
FASTENERS	O							
GASKETS	O							
SUB CONTRACTS								
FAB STRUCTURALS					O			
SUPPORTING STRUCTURALS					O			
STRUCTURE SUB ASSEMBLY					O			
FAB PIPES					O			
GRATINGS					O			
STAIR CASES					O			
HANDRAILS/ PLATFORMS					O			
BOUGHT OUT COMPONENTS								
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)					O			
PIPE FITTINGS								
CS PIPES, TUBES					O			
SS PIPES, TUBES					O			
FIN TUBES	O							
ELBOWS		O			O			
FLANGES	O	O						
VALVES	O							
GAUGES	O							
DEMISTERS		O						
ABSCRBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)						O		
PAINT TINS		O						
PAINT DRUMS						O		
IGNITORS	O							
SPRAY NOZZLES	O							
ELECTRICAL INSTRUMENTATION								
MOTORS, PUMPS, COMPRESSORS, TURBINES	O							
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		O						
INDICATORS, VIBRATOR SWITCHES	O							

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
CABLE BUNDLES, CABLE DRUMS					O			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		O						
OPERATIONAL SPARES	O							

13 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

13.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.

13.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.

13.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.

13.4 For critical items, where specified, special handling fixtures shall be used for lifting.

13.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.

13.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.

13.7 Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

13.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

a) The markings showing the upright position.

b) The markings showing the sling position

c) Markings showing the fragile contents.

d) Other required markings as per clause no.10

13.8.1 Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15º.

13.8.2 Handling and lifting should be done without jerks or impacts.

13.8.3 Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

13.8.4 On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

13.8.5 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

13.8.6 Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

14 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

14.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):
   - Well Bed Length : 10000mm
   - Over Gooseneck : 13000mm
   - Width : 3000mm
   - Carrying Capacity : 40MT

2. LOW BED TRAILERS (LB 16):
   - Well Bed Length : 12000mm
   - Over Gooseneck : 16000mm
   - Width : 3000mm
   - Carrying Capacity : 75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length
   (for Exceptional equipment length: 30000mm and above)

   Bigger Dia equipment are loaded in the Well with overhanging.

   Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.
   The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

14.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

Wooden Saddles	For Diameter up to 4000mm	For Diameter above 4000mm
Length:	1836/2743mm (6'0"/9'0")	3353mm (11'0")
Width:	300mm (1'0")	300mm (1'0")
Height:	Saddle + one/two wedges a top	Saddle + three/four wedges a top

Number of Saddles:	
Minimum	3 in case of Loading inside Well +1 when loaded on Gooseneck
Maximum:	4 in case of Loading inside Well +2 when loaded on Gooseneck

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

14.3 NUMBER OF LASHINGS:

	CONSIGNMENT LOADED INSIDE WELL BED	CONSIGNMENT LOADED OVER GOOSENECK
a) up to 40MT	4 (2 Single Line lashing 2 Double Line Lashing)	5 (3 Single Line Lashing 2 Double Line Lashing)
b) 40MT to 60MT	5 (3 Single Line Lashing 2 Double Line Lashing)	5 (Single Line Lashing 3Double Line Lashing)
c) 60MT and above	5 (2 Single Line Lashing 3 Double Line Lashing)	6 (3 Single Line Lashing 3 Double Line Lashing)

15 GUIDELINES FOR HANDLING/LOADING/LASHING

15.1 HANDLING

Figure 6

Before unloading the jobs Completely painted and neatly stencilled will be checked.

Pipes with split type end cover will be checked

Figure 7

All Coil Tubes to be provided with End Caps.

Figure 8

Neatly stacked Coil Assemblies.

Figure 9

Columns to be lifted with Nylon belts. This protect painting, edges and attachments.

Figure 10

15.2 LOADING

All the components to be transported by putting inside the properly fabricated Crating

Figure 11

Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.

Figure 12

No component loaded over the crating.

Figure 13

Headers supported with wooden V blocks at 3 meters interval.

Figure 14

Spacers in between each coil assembly.

Figure 15

Goose pipe to be provided with rubber pad protects removal of painting and damage to the job.

Figure 16

15.3 LASHING

Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.