

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
1.15	TEMPERATURE GAUGE	(a)	GOA THERMOSTATIC INSTRUMENTS, GOA
		(b)	GENERAL INSTRUMENTS CONSORTIUM,
		(c)	A.N. INSTRUMENTS PVT. LTD., KOLKATA
		(d)	H. GURU INSTRUMENTS (SOUTH INDIA), BANGALORE
		(e)	FORBES MARSHALL, HYDERABAD
		(f)	WIKA INSTRUMENTS INDIA PVT. LTD., PUNE
		(g)	WAREE, DADRA GOA INSTRUMENTS PVT. LTD.,
		(h)	BELLS CONTROLS LTD., KOLKATA
		(i)	SWITZER INSTRUMENTS LTD., CHENNAI
		(j)	WIKA ALEXANDER WIEGAND GMBH&CO., GERMANY
		(k)	BUDENBURG GUAGE CO. LTD.
1.16	SWITCHES (PRESSURE, DIFF. PRESSURE)	(l)	INDOSONIC INSTRUMENT, MUMBAI
		(a)	INDFOSS INDUSTRIES LTD., GHAZIABAD
		(b)	SWITZER INSTRUMENTS COMPANY, CHENNAI
		(c)	SOR INC., USA
		(d)	PYROELECTRIC, GOA
		(e)	DRESSER INDUSTRIES INC, USA
		(f)	REGULATEURS GEORGIN, FRANCE

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		(g)	DELTA CONTROLS LTD., U.K.
		(h)	KDG INSTRUMENTS LTD. U.K.
		(i)	ASHCROFT
		(j)	DWAYER, USA
		(k)	GENERAL INSTRUMENTS CONSORTIUM
1.17	TEMPERATURE SWITCH	(a)	INDFOSS INDUSTRIES LTD., GHAZIABAD
		(b)	SWITZER INSTRUMENTS COMPANY, CHENNAI
		(c)	GENERAL INSTRUMENTS CONSORTIUM, MUMBAI
		(d)	SOR INC., USA
		(e)	PYROELECTRIC, GOA DRESSER INDUSTRIES INC, USA
		(f)	REGULATEURS GEORGIN, FRANCE
		(g)	DELTA CONTROLS LTD., U.K.
		(h)	KDG INSTRUMENTS LTD. U.K.
1.18	AIR FILTER REGULATOR	(a)	PLACKA, CHENNAI
		(b)	SHAVO NORGREN, INDIA
1.19	MASS FLOW METER (CORROLIOUS PRINCIPLE)	(a)	EMERSON PROCESS MANAGEMENT (I) LTD
		(b)	ABB
		(c)	YOKOGAWA
		(d)	ENDRESS+ HAUESER
		(e)	GE SENSING & INSPECTION TECHNOLOGIES
		(f)	FORBES MARSHALL

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1.20	I/P CONVERTER	(a)	ECKHARDT, GERMANY
		(b)	MTL, CHENNAI
		(c)	ABB
		(d)	WATSON SMITH (PRESENTLY NORGREN)
		(e)	EMERSON PROCESS MGMT ASIA PACIFIC LTD.
		(f)	MOORE CONTROLS
1.21	FLOW ELEMENTS	(a)	INSTRUMENTATION LTD.
		(b)	MICRO PRECISION PRODUCTS
		(c)	ENGINEERING SPECIALITIES PVT. LTD.
		(d)	GENERAL INSTRUMENTS
1.22	LEVEL GAUGES (FLOAT TYPE)	(a)	SB ELECTRO
		(b)	SIGMA
		(c)	V AUTOMAT
		(d)	LEVCON
		(e)	CHEMTROLS
		(f)	ASIAN INDUSTRIAL VALVES
1.23	ORP TRANSMITTERS	(a)	FORBES MARSHALL
1.24	DENSITY METER (NUCLEONIC TYPE)	(a)	ENDRESS + HAUSER
		(b)	THERMO MEASURE TECH.
		(c)	CHEMTROL (THERMO FISHER)
1.25	DENSITY METER (NON-NUCLEONIC TYPE)	(a)	ENDRESS + HAUSER
		(b)	THERMO MEASURE TECH.
		(c)	CHEMTROL (THERMO FISHER)

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1.26	SOLID MASS FLOW METER	(a)	SIEMENS MILLTRONICS
		(b)	CHEMTROL (THERMO FISHER)
		(c)	SIEMENS INSTRUMENTS, CANADA
1.27	PULL CORD SWITCH	(a)	JAYASHREE ELECTRODEVICES PVT. LTD.
		(b)	A.G. SYSTEM CONTROLS, MUMBAI
1.28	BELT SWAY SWITCH	(a)	JAYASHREE ELECTRODEVICES PVT. LTD.
		(b)	A.G. SYSTEM CONTROLS, MUMBAI
1.29	ZERO SPEED SWITCH	(a)	A.G. ELECTRONICS
		(b)	JAYASHREE ELECTRODEVICES PVT. LTD.
1.30	PROXIMITY SWITCH	(a)	AW
		(b)	JAYASHREE ELECTRODEVICES PVT. LTD.
1.31	LEVEL SWITCH (RF TYPE)	(a)	EIP ENVIRO LEVEL CONTROLS
2.0	<u>DCS, HMI, MONITORING AND PLC SYSTEMS:</u>		
2.1	DDCMIS	(a)	ABB.
		(b)	YOKOGAWA
		(c)	SIEMENS.
		(d)	BHEL
		(e)	EMERSON PROCESS MANAGEMENT
		(f)	MHI
2.2	PLC	(a)	ALLEN BRADLEY.
		(b)	SCHNEIDER
		(c)	ROCKWELL

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		(d)	GE FANUC
2.3	MASTER SLAVE CLOCK	(a)	SYMMETRICOM INC., USA
		(b)	HOPF, GERMANY
		(c)	HATHWAY, USA
		(d)	SERTEL ELECTRONICS, CHENNAI
		(e)	ADVANCE MICRONIC
2.4	DOT MATRIX PRINTER	(a)	HP / EPSON / WIPRO / TVS / SAMSUNG
2.5	LASER & COLOUR INKJET PRINTERS	(b)	HP / EPSON / CANON / IBM / XEROX / SAMSUNG
2.6	COMPUTERS FOR OPERATOR / ENGINEER / HISTORY STATION, SHIFT SUPERVISOR, STORIAN, SOFT LINK STATION FOR INTERFACING WITH OTHER SYSTEMS, PERFORMANCE CALCULATION AND SER STATION	(a)	IBM
		(b)	DELL
		(c)	HP/COMPAQ
2.7	TFT MONITOR	(a)	LG / SAMSUNG / HP / COMPAQ / IBM / DELL
2.8	VIBRATION MONITORING SYSTEM & TURBO-SUPERVISORY INSTRUMENTS	(a)	ROCKWELL AUTOMATION, USA
		(b)	BENTLEY NEVADA, USA / INDIA
		(c)	SHINKAWA, JAPAN / FORBES MARSHALL,
		(d)	VIBROMETER, SWITZERLAND
2.9	LARGE VIDEO SCREENS	(a)	BARCO BELGIUM / BARCO, INDIA
		(b)	PLANAR, USA / PYROTECH, INDIA
		(c)	CHRISTIE, USA / CHRISTIE, INDIA

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		(d)	SYNELEC
		(e)	DELTA, THAILAND / DELTA POWER SYSTEMS, INDIA
2.10	HART COMMUNICATOR	(a)	HONEYWELL, USA/PUNE
		(b)	EMERSON PROCESS (FORMERLY FISHER ROSEMOUNT), USA / DAMAN
		(c)	YOKOGAWA, JAPAN / YOKOGAWA, INDIA
		(d)	MERIAM, USA / CHEMTROLS, MUMBAI
		(e)	ABB, GERMANY / INDIA
		(f)	FUJI, JAPAN
2.11	HART MANAGEMENT SYSTEM	(a)	PEPPERL+FUCKS, GERMANY / INDIA
		(b)	MTL, UK / INDIA
		(c)	EMERSON PROCESS, USA / DAMAN
2.12	ALARM ANNUNCIATION SYSTEM	(a)	PROCON, CHENNAI
		(b)	IIC, HYDERABAD
		(c)	MINILEC, PUNE
		(d)	IIC, MUMBAI
		(e)	PIRIE, MUMBAI
		(f)	PECON, VADODARA
		(g)	POSITRONICS
2.13	RCMS (ROTATING MACHINE CONDITION MONITORING SYSTEM)	(a)	VIBROTECH (M/S MEGITT INDIA PVT. LTD.)
		(b)	M/S SKF INDIA LTD.
2.14	ACOUSTIC PYROMETER	(a)	BONNENBERG + DRESCHER GMBH, GERMANY

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2.15	ACOUSTIC STEAM LEAK DETECTION SYSTEM (ASLD)	(a)	HI-TECH SYSTEM & SERVICES LTD, NEW DELHI (AMI MAKE)
		(b)	SARTECH INTL, CHENNAI (INSTROTECH MAKE INSPECTA FFT
2.16	EPABX SYSTEM	(a)	SIEMENS
		(b)	BPL
2.17	FURNACE TV CAMERA SYSTEM	(c)	HITECH SYSTEM & SERVICES LTD. (M/S LENOX INSTRUMENT COMPANY INC., USA
3.0	<u>ELECTRICAL & SECONDARY INSTRUMENTS:</u>		
3.1	DIGITAL INDICATOR	(a)	ABB, GERMANY / FARIDABAD
		(b)	MASSIBUS, GANDHINAGAR PYROTECH, UDAIPUR
		(c)	LEKTROTEK, PUNE
		(d)	GOSEN / CAMILLE BAUER / METRAWATT YOKOGAWA, JAPAN / INDIA
		(e)	SIEMENS
3.2	BARGRAPH INDICATORS	(a)	ABB, GERMANY / FARIDABAD
		(b)	MASSIBUS, GANDHINAGAR
		(c)	PYROTECH, UDAIPUR
		(d)	LEKTROTEK, PUNE
		(e)	GOSEN / CAMILLE BAUER / METRAWATT
		(f)	M-SYSTEM, JAPAN (CHINO LAXSONS DAMAN)
		(g)	SIEMENS

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3.3	PEN, POINT AND CHARTLESS RECORDERS	(a)	EUROTHERM, UK
		(b)	TATA HONEYWELL
		(c)	YOKOGAWA, JAPAN (YOKOGAWA, INDIA)
		(d)	CHINO (LAXSON), JAPAN
		(e)	ABB, UK / GERMANY
		(f)	FUJI ELECTRIC, JAPAN
3.4	TRANSDUCERS	(a)	SEIMENS
		(b)	AUTOMATIC ELECTRIC LTD., MUMBAI
		(c)	PYROTECH, UDAIPUR
		(d)	SOUTHERN TRANSDUCERS, CHENNAI
		(e)	ACCORD, PUNE MECO, MUMBAI
		(f)	ABB
		(g)	SITU, MUMBAI
		(h)	RISHABH
		(i)	ADEPT, PUNE
3.5	ELECTRICAL ANALOG (PANEL) METERS	(a)	AUTOMATIC ELECTRIC LTD., MUMBAI
		(b)	MECO, MUMBAI
		(c)	RISHAB, NASIK
3.6	SELECTOR SWITCHES AND CONTROL SWITCHES	(a)	KAYCEE
		(b)	ALSTOM
		(c)	L & T
		(d)	SIEMENS

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3.7	MOSAIC ANALOG (MOVING COIL) INDICATORS	(a)	GOSSEN, GERMANY
		(b)	WEIGEL, GERMANY
3.8	MOSAIC DIGITAL INDICATORS	(a)	GOSSEN, GERMANY
		(b)	WEIGEL, GERMANY
3.9	INTERPOSING RELAYS FOR COMMAND OUTPUT TO MCC	(a)	JYOTI
		(b)	H&B
		(c)	ALSTOM
		(d)	ELASTA
		(e)	OEN SIEMENS
		(f)	ABB
3.10	RELAYS / AUX. CONTACTORS	(a)	TELEMECANIQUE & CTRLS
		(b)	ABB
		(c)	SIEMENS
		(d)	GEC – ALSTOM
		(e)	L & T
3.11	LIMIT SWITCHES	(a)	BHARTIYA CUTLER & HAMMER, FARIDABAD
3.12	MINIATURIZED PUSH BUTTONS / ILPB (24X48MM) MOSAIC GRID COMPATIBLE	(a)	SIEMENS
		(b)	TEW, GERMANY (OLD NAME SUBKLEW)
4.0	<u>CONTROL DESKS & PANELS:</u>		
4.1	UNIT CONTROL PANELS (UCP)/ ELECTRICAL CONTROL PANEL (ECP)/ CONTROL DESK (MOSAIC GRID BASED)	(a)	BHEL EDN
		(b)	PYRO TECH, UDAIPUR
		(c)	INSTRUMENTATION LTD. KOTA
		(d)	KHODAY CONTROL SYSTEMS, BANGALORE

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		(e)	CHEMIN CONTROLS, PONDICHERRY
4.2	CRT DESK / OPERATOR DESK	(a)	PYRO TECH, UDAIPUR
		(b)	INSTRUMENTATION LTD. KOTA
		(c)	KHODAY CONTROL SYSTEMS, BANGALORE
		(d)	CHEMIN CONTROLS, PONDICHERRY
4.3	MOSAIC GRID/ MOSAIC TILES & OTHER MOSAIC ITEMS	(a)	SYMO, SWITZERLAND
		(b)	TEW, GERMANY (OLD NAME SUBKLEW)
		(c)	PYROTECH
4.4	LOCAL PANELS / DISTRIBUTION BOARDS	(a)	CONTROL & SCHEMATICS
		(b)	PYROTECH
		(c)	RITTAL
		(d)	L&T
4.5	TERMINAL BLOCKS	(e)	ELMEX
		(f)	PHOENIX
		(g)	WAGO
5.0	<u>ANALYSERS:</u>		
5.1	SWAS ANALYSERS	(a)	POLYMETRON / ZELLWEGGER – ANALYTICALS
		(b)	ABB
		(c)	ORION, USA
		(d)	ROSEMOUNT ANALYTICAL-CHEMPURE,
		(e)	HACH ULTRA FRANCE,
		(f)	HACH USA

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		(g)	YOKOGAWA
		(h)	AMETECH
		(i)	FORBES MARSHALL
		(j)	EMERSON
5.2	SWAS (STEAM AND WATER ANALYSIS SYSTEM) PANELS	(a)	ABB KENT, U.K.
		(b)	ABB LTD. FARIDABAD
		(c)	FORBES MARSHAL
		(d)	EMERSON PROCESS MANAGEMENT INSTRUMENTATION LTD., KOTA
		(e)	YOKOGAWA
5.3	CO ANALYSER (IN SITU TYPE)	(a)	AMETEK, USA / SINGAPORE
		(b)	CODEL INTERNATIONAL LTD. UK
		(c)	LAND COMBUSTION UK
5.4	OXYGEN IN FLUE GAS ANALYSER (ZIRCONIA PROBE TYPE)	(a)	AMETEK, USA / SINGAPORE
		(b)	LAND INSTRUMENTS, UK
		(c)	EMERSON PROCESS MANAGEMENT (I) LTD
		(d)	YOKOGAWA, JAPAN
		(e)	ENOTECH, GERMANY
		(f)	ABB, UK
		(g)	TELEDYNE, USA
		(h)	FUJI (AIC)
5.5	SMOKE DENSITY ANALYSER / PARTICULATE EMISSION ANALYSER / OPACITY ANALYSER	(a)	DURAG, GERMANY
		(b)	CODEL, UK
		(c)	LAND COMBUSTION UK

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		(d)	EMERSON
		(e)	ABB
		(f)	FUJI (AIC)
5.6	NOX / SO2 ANALYSER (IN SITU)	(a)	CODEL, UK
		(b)	FORBES MARSHALL
		(c)	LAND COMBUSTION, UK
5.7	OZONE ANALYSER	(a)	BMT MESSTECHNIK, GMBH
5.8	RESIDUAL OZONE ANALYSER	(a)	ECO SENSORS / KAUFFMANN UMWITTECHNIK .EK
5.9	OZONE LEAK DETECTOR	(a)	OTTPL
6.0	<u>CONTROL VALVES / ACTUATORS / SOLENOID VALVES:</u>		
6.1	ELECTRICAL ACTUATORS FOR REGULATING & OPEN / CLOSE VALVES	(a)	ROTORK CONTROL (INDIA) LTD.,
		(b)	AUMA (INDIA) LTD.,
		(c)	LIMITORQUE INDIA LTD.
6.2	PNEUMATIC ACTUATORS-REGULATING & OPEN / CLOSE	(d)	INSTRUMENTATION LTD., PALGHAT
		(e)	KELTRON CONTROLS, KERALA
6.3	SH/RH SPRAY CONTROL VALVES	(a)	MIL CONTROLS LTD.
	SH/RH SPRAY BLOCK VALVES	(b)	INSTRUMENTATION LTD. PALGHAT
	FEED CONTROL VALVES	(c)	FISHER SANMAR LTD.
		(d)	CONTROL COMPONENT INC., USA
		(e)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.4	LFO/HFO CONTROL, AND TRIP VALVES, FLOW CONTROL, PRESSURE	(a)	MIL CONTROLS LTD.
		(b)	INSTRUMENTATION LTD. PALGHAT

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	CONTROL, TEMP. CONTROL, AND BURNER TRIP VALVES, BALL VALVES	(c)	FOURESS ENGG (I) LTD, BANGALORE
		(d)	SAMSON CONTROLS , PUNE
6.5	SOOT BLOWER PRESSURE REDUCING VALVE	(a)	MIL CONTROLS LTD.
		(b)	INSTRUMENTATION LTD., PALGHAT
		(c)	FISHER SANMAR LTD.
		(d)	CONTROL COMPONENT INC., USA
		(e)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.6	APRDS CONTROL VALVES	(a)	INSTRUMENTATION LTD.
		(b)	CONTROL COMPONENT INC., USA
		(c)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.7	CONTROL VALVES- NON CRITICAL	(a)	DEZURIK COPES VULCAN LTD., U.K.
		(b)	CONTROL COMPONENT INC., USA
		(c)	FISHER SANMAR LIMITED
		(d)	INSTRUMENTATION LTD
		(e)	MIL CONTROL LTD.
		(f)	FISHER XOMOS SANMAR LTD.
		(g)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.8	SOLENOID VALVE	(a)	ASCO, CHENNAI
		(b)	ROTEX AUTOMATION LTD., GUJRAT
		(c)	AVCON CONTROLS, MUMBAI
6.9	HP/LP BYPASS VALVES	(a)	BOPP & REUTHER SR GMBH CONTROL COMPONENTS INC (CCI)

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6.10	ELECTRO-HYDRAULIC ACTUATOR	(a)	LEONARDO AUTOMATION (INDIA) PVT. LTD.
7.0	<u>ERECTION HARDWARES:</u>		
7.1	LOCAL INSTRUMENT RACK (LIR) AND LOCAL INSTRUMENT ENCLOSURES (LIE)	(a)	PYROTECH, UDAIPUR
		(b)	INSTRUMENTATION LTD., KOTA
		(c)	ELECTRONICS CORPORATION OF INDIA LTD., HYDERABAD
		(d)	CHEMIN CONTROLS, PONDICHERRY
		(e)	PRAMMEN INDUSTRIES
7.2	INSTRUMENT VALVES	(a)	EXCEL HYDRO PNEUMATICS PVT. LTD., MUMBAI
		(b)	BHEL
		(c)	METPRESS ENGINEERING WORKS, KOLKATA
		(d)	BALDOTA VALVE & FITTING CO. PVT. LTD., MUMBAI
		(e)	AURA INC., NEW DELHI
		(f)	INSTRUMENTATION LTD. PALGHAT
		(g)	PRECISION ENGG. INDUSTRIES, MUMBAI
		(h)	VIKAS INDUSTRIAL PRODUCTS, NEW DELHI
7.3	VALVE MANIFOLDS	(a)	EXCEL HYDRO PNEUMATICS PVT. LTD., MUMBAI
		(b)	METPRESS ENGINEERING WORKS, KOLKATA

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		(c)	BALDOTA VALVE & FITTING CO. PVT. LTD., MUMBAI
		(d)	AURA INC., NEW DELHI
		(e)	PRECISION ENGG. INDUSTRIES, MUMBAI
		(f)	HP VALVES AND FITTINGS, CHENNAI
7.4	COMPRESSION FITTINGS / SOCKET WELD FITTINGS	(a)	SWAGELOCK, USA
		(b)	ASTEC VALVES & FITTINGS PVT. LTD.
		(c)	MET-LOK HYDRO PNEUMATICS PVT. LTD.
7.5	CONDENSATE POTS	(a)	EXCEL HYDRO-PNEUMATICS PVT. LTD., MUMBAI
		(b)	MICROPRECISION, FARIDABAD
		(c)	INSTRUMENTATION LTD. PALGHAT
		(d)	METPRESS ENGINEERING WORKS, KOLKATA
		(e)	BALDOTA VALVES & FITTINGS CO. PVT. LTD., MUMBAI
		(f)	PRECISION ENGG. INDUSTRIES, MUMBAI
7.6	IMPULSE & SAMPLE PIPINGS	(a)	TPS TECHNITUBE ROHREN WERKE GMBH, GERMANY
		(b)	MAHARASHTRA SEAMLESS LTD.
		(c)	BHEL
		(d)	CHOKSI TUBE COMPANY LTD., INDIA
		(e)	INDIAN SEAMLESS METAL TUBES LTD., INDIA
		(f)	MANNESMANN AG, GERMANY

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		(g)	TOUVAY AND CAUVIN GULF EC, DUBAI
		(h)	JINDAL SAW PIPES LTD., INDIA
		(i)	SUMITOMO CORPORATION, JAPAN / KAWASAKI
		(j)	RATNAMANI METALS & TUBES LTD., AHMEDABAD
7.7	JUNCTION BOX (FRP)	(a)	DEVI POLYMERS, CHENNAI
		(b)	SUCHITRA INDUSTRIES, BANGALORE
		(c)	RITTAL
		(d)	PYROTECH
		(e)	L&T
		(f)	HENSEL ELECTRIC INDIA PVT. LTD., SRIPERUMBUDUR
7.8	AIR CYLINDER	(a)	VELJAN HYDRAIR, HYDERABAD
		(b)	NUCON INDUSTRIES, HYDERABAD
		(c)	PRECISION ENGG. (PREAC), BANAGALORE
		(d)	ASCO, CHENNAI
8.0	<u>CABLES:</u>		
8.1	CONTROL CABLES	(a)	DELTON CABLES, FARIDABAD
		(b)	UNIVERSAL CABLES, SATNA
		(c)	NICCO CABLE, KOLKATA
		(d)	POLYCAB, DAMAN
		(e)	GAYOLENE, MUMBAI
		(f)	RELIANCE ENGRS, BANGALORE
		(g)	CORDS CABLES, RAJASTHAN

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
		(h)	PARAMOUNT CABLES, ALWAR
		(i)	THERMOCABLES, BANGALORE,
		(j)	KEI INDUSTRIES LTD., CHENNAI
8.2	INSTRUMENTATION CABLE	(a)	DELTON CABLES, FARIDABAD
		(b)	UNIVERSAL CABLES, SATNA
		(c)	NICCO CABLE, KOLKATA
		(d)	POLYCAB, DAMAN
		(e)	GAYOLENE, MUMBAI
		(f)	RELIANCE ENGRS, BANGALORE
		(g)	CORDS CABLES, RAJASTHAN
		(h)	PARAMOUNT CABLES, ALWAR
		(i)	THERMOCABLES, BANGALORE / HYDERABAD
		(j)	KEI INDUSTRIES LTD., CHENNAI
		(k)	CABLE CORPRN OF (I) LTD., CHENNAI
		(l)	RPG CABLES LTD., CHENNAI
		(m)	FORT GLOSTER INDUSTRIES LTD. KOLKATA
		(n)	DECO CABLES, DELHI
		(o)	KRISHNA CABLES, GWALIOR
		(p)	THERMAPADS (P) LTD
		(q)	ELKAY TELELINKS LTD.
		(r)	INCAB INDUSTRIES LTD
		(s)	TORRENT CABLE LTD.
8.3	COMPENSATING CABLES	(a)	DELTON CABLE

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAVAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
		(b)	TOSHNIWAL, MUMBAI RELIANCE, BANGALORE
		(c)	LAPP INDIA, MUMBAI/ BANGALORE
		(d)	CORDS CABLES, RAJASTHAN
		(e)	PARAMOUNT CABLE
8.4	SPECIAL CABLES (PTFE /FEP INSULATED CABLES)	(a)	TOSHNIWAL CABLE
		(b)	RELIANCE CABLES
		(c)	LAPP INDIA, MUMBAI
		(d)	PARAMOUNT CABLES
		(e)	FINOLEX, PUNE
8.5	POWER CABLES (LT)	(a)	DELTON CABLES, FARIDABAD
		(b)	UNIVERSAL CABLES, SATNA
		(c)	NICCO CABLE, KOLKATA
		(d)	CORDS CABLES, RAJASTHAN
		(e)	FORTGLASTER INDUSTRIES
		(f)	INCAB, PUNE
		(g)	CCIL, BANGALORE
		(h)	KEI INDUSTRIES LTD., CHENNAI
		(i)	POLYCAB, DAMAN PARAMOUNT CABLES, ALWAR
9.0	<u>UPS / DC SYSTEM:</u>		
9.1	UPS WITH ACDB	(a)	HI-REL ELECTRONICS
		(b)	EMERSON NETWORK (FORMERLY TATA LIEBERT)
		(c)	DB POWER ELECTRONICS
9.2	24 VDC BATTERY CHARGER	(a)	CALDYNE, KOLKATA

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
	WITH DCDB	(b)	AMARARAJA, TIRUPATI
		(c)	CHHABI ELECTRICALS, JALGAON
		(d)	HL POWER SYSTEMS, HYDERABAD
		(e)	MASS TECH CONTROLS
9.3	BATTERY (TUBULAR/PLANTE) (TUBULAR) (TUBULAR)	(a)	EXIDE, KOLKATA
		(b)	HL NIFE, HYDERABAD UNION BATTERY (BUI PUNE)
9.4	BATTERY (NICKEL- CADMIUM)	(a)	HL POWER SYSTEMS, HYDERABAD
		(b)	AMCO, BANGALORE

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

5.0 LIST OF APPROVED VENDORS – CIVIL

<u>SR.NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
	<u>NDCT</u>		
1.0	FILL	(a)	BRENTWOOD
		(b)	MUNTERS EUROFORM
		(c)	PAHARPUR
		(d)	HAMON
		(e)	MMAQUA
		(f)	COOLDECK
2.0	FILL GLUE	(a)	AS PER FILL MANUFACTURER'S RECOMMENDATION
3.0	TESTING AGENCY FOR PVC FILL	(a)	SRIRAM LABS, NEW DELHI
		(b)	CIPET, CHENNAI
4.0	SLIDE GATES	(a)	GMW
		(b)	MACMAT
		(c)	MAHINDRA ASSOCIATES
5.0	STEEL	(a)	SAIL
		(b)	TATA
		(c)	JINDAL
		(d)	VIZAG STEEL
6.0	PVC PIPES	(a)	FINOLEX
		(b)	SUPREME CHEMPLAST
		(c)	PRINCE
7.0	PUSH TROLLEY, CHAINPULLEY BLOCK, HOOK & CHAIN	(a)	WMI
		(b)	INDEF
8.0	RED OXIDE ZINC CHROMATE	(a)	'APCOMIN' OF ASIAN PAINTS

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
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<u>SR.NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
	PRIMER	(b)	BISON UNIVERSAL OF BRITISH PAINTS
		(c)	'3100' OF JANSON & NICHOLSON
		(d)	SYNTHETIC ZINC CHROMATE OF SHALIMAR PAINTS
9.0	EPOXY PRIMER	(a)	HINDUSTAN CIBA GEIGY
		(b)	DR.BECK & CO
		(c)	CHEM.E.LEEK
		(d)	EQUIVALENT
10.0	EPOXY PAINT	(a)	HINDUSTAN CIBA GEIGY
		(b)	DR.BECK & CO
		(c)	EQUIVALENT
11.0	AVIATION WARNING LIGHTS	(a)	FLASH TECHNOLOGY
		(b)	USA
		(c)	AVAIDS TECHNOVATORS PVT LTD
		(d)	GURGAON OR EQUIVALENT.
12.0	NOZZLES	(a)	ZEMCAL (INDIA)
		(b)	VALQUA PRODUCTS CHENNAI OR EQUIVALENT.
13.0	AC PIPES	(a)	KANORIA
		(b)	CHARMINAR
		(c)	MRK PIPES, JAIPUR OR EQUIVALENT.
	<u>VENDORS FOR OTHER CIVIL WORKS</u>		
1.0	TMT REINFORCEMENT BAR	(a)	STEEL AUTHORITY OF INDIA LTD (SAIL)
		(b)	TATA IRON & STEEL CO. LTD
		(c)	RASHTRIYA ISPAT NIGAM LTD (RINL)

**TECHNICAL SPECIFICATION FOR
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<u>SR.NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
		(d)	M/S. SHYAM STEEL INDUSTRIES LIMITED, KOLKATA
		(e)	ESSAR STEEL.
		(f)	JSW STEEL.
2.0	CEMENT	(a)	THE ASSOCIATED CEMENT COMPANIES LTD. (ACC)
		(b)	AMBUJA CEMENT LTD.
		(c)	ULTRA TECH CEMENT LTD.
		(d)	M/S ANDHRA CEMENT
		(e)	M/S. INDIANA CEMENTS LIMITED.
		(f)	MANIKGAD CEMENTS
		(g)	ORIENT CEMENTS
3.0	STRUCTURAL STEEL	(a)	STEEL AUTHORITY OF INDIA LTD (SAIL)
		(b)	TATA IRON & STEEL CO. LTD
		(c)	RASHTRIYA ISPAT NIGAM LTD (RINL)
		(d)	JINDAL STEEL
		(e)	ESSR STEEL.
4.0	STAINLESS STEEL	(a)	STEEL AUTHORITY OF INDIA LTD. (SAIL)
5.0	GROUTING MATERIAL	(a)	FOSROC CHEMICALS (I) PVT LTD.
		(b)	M/S BASF (INDIA)
		(c)	SIKA QUALCRETE PVT LTD.
		(d)	CICO TECHNOLOGIES LTD
		(e)	M/S BLACK CAT ENTERPRISES
		(f)	M/S PIDILITE INDUSTRIES
6.0	PLASTICISER IN WATER PROOFING MATERIAL	(a)	FOSROC CHEMICALS (I) PVT LTD
		(b)	SIKA QUALCRETE PVT LTD

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
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MAHARASHTRA, INDIA.**

<u>SR.NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
		(c)	CICO TECHNOLOGIES LTD
		(d)	M/S. BLACKCAT ENTERPRISES
		(e)	M/S BASF CONSTRUCTION CHEMICALS
		(f)	M/S PIDILITE INDUSTRIES
7.0	WELDING ELECTRODES	(a)	M/S. ESAB INDIA LIMITED
		(b)	M/S. ADOR WELDING LIMITED
		(c)	M/S. GENERAL ELECTRODES & EQUIPMENTS LIMITED
		(d)	M/S. MODI ELECTRODES LIMITED
		(e)	M/S. MORGARDSHARMMER INDIA LTD., DELHI.
		(f)	M/S. WELDWELL ELECTRODES, NAGPUR.
8.0	ROOF WATER PROOFING – BITUMINOUS MEMBRANE	(a)	SHALIMAR TAR PRODUCTS LTD
		(b)	TEXA
9.0	ROOF WATER PROOFING – ELASTOMERIC MEMBRANE OR CHEMICAL (PAINT/ADMIXTURE/COMPOUND)	(a)	TEXA
		(b)	ICHNOCHEM PVT LTD
		(c)	LLOYD
		(d)	SIKA INDIA PVT. LTD.
		(e)	ZYDEX
10.0	ROOF INSULATION – OVER DECK FOAM CONCRETE EXTRUDED POLYSTYRENE BLOCK	(a)	SIPOREX
		(b)	SUPREME INSUBOARD
11.0	FALSE CEILING-		
	(A) ALUMINIUM	(a)	LLOYD
		(b)	ARMSTRONG
		(c)	LUXALON BY HUNTER DAUGLAS,

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CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
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<u>SR.NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
	(B) MINERAL FIBRE / GYPSUM BOARD	(a)	ARMSTRONG
		(b)	INDIA GYPSUM
		(c)	AMF
		(d)	EVEREST
12.0	ALUMINIUM EXTRUDED SECTIONS	(a)	HINDALCO
		(b)	DOMAL-HYDRO SYSTEMS
13.0	STEEL DOOR	(a)	NCL ALTEK & SECCOLOR LTD
		(b)	AGEW STEEL MFRS P LTD
		(c)	GANDHI ENTRANCE AUTOMATION PVT LTD.
		(d)	GODREJ
14.0	STEEL GATE	(a)	GANDHI ENTRANCE AUTOMATION PVT LTD.
15.0	FIRE DOOR	(a)	GODREJ
		(b)	NAVAIR
		(c)	GANDHI ENTRANCE AUTOMATION PVT LTD.
		(d)	PROMAT
16.0	STEEL WINDOW	(a)	NCL ALTEK & SECCOLOR LTD
17.0	DOOR HARDWARE	(a)	HAFELE
		(b)	GODREJ
		(c)	DORMA
18.0	STEEL REINFORCED PVC DOORS & WINDOWS	(a)	FENESTA BY DSC LTD.
19.0	ROLLING SHUTTER	(a)	DITEC-GANDHI ENTRANCE AUTOMATION PVT. LTD
20.0	PAINTS	(a)	ICI
		(b)	BERGER
		(c)	ASIAN PAINTS

**TECHNICAL SPECIFICATION FOR
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1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

<u>SR.NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
		(d)	NEROLAC
		(e)	SNOWCEM
21.0	GRANULAR TEXTURED FINISH	(a)	VINERATEX
		(b)	HERITAGE OF BAKELITE HYLAM
22.0	SYNTHETIC PLASTER	(a)	RENOVO
23.0	ALUMINIUM COMPOSITE PANELS- NAME OF SYSTEM PROVIDER-	(a)	ALUDECOR
		(b)	EUROBOND
		(c)	ALU BOND
24.0	METAL CLADDING – INSULATED AND NON INSULATED	(a)	LLOYD INSULATIONS (INDIA) LTD
		(b)	TATA BLUE SCOPE STEEL
		(c)	CRIL
		(d)	METECHNO
25.0	METALLIC FLOOR HARDENER NON METALLIC FLOOR HARDENER	(a)	IRONITE
		(b)	SIKA INDIA PVT. LTD.
26.0	SELF LEVELLING EPOXY FLOORING	(a)	SIKA INDIA PVT. LTD.
27.0	VITRIFIED TILES	(a)	MARBONITE
		(b)	"FERRASTONE" OR "HARDSTONE" OF "BOSS PROFILE LTD"
		(c)	RESTILE
		(d)	ENDURA" OF H & R JONSON (INDIA) PVT. LTD
		(e)	KAJARIA
		(f)	NITCO
28.0	CHEMICAL RESISTANT TILES	(a)	CHEMSTONE OF BOSS PROFILES LTD
		(b)	RESTILE CERAMICS LTD

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
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<u>SR.NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
		(c)	FOSROCK
29.0	CHEMICAL RESISTANT THERMO PLASTIC PPG LINING ROLLS	(a)	CRESCENT TECHNOLOGIES PVT. LTD
30.0	VINYL FLOORING	(a)	ARMSTRONG
		(b)	WONDER FLOOR
		(c)	KRISHNA VINYL
31.0	GLASS	(a)	PILKINGTON GLASS INDIA PVT. LTD.
		(b)	AIS OF ASAHI INDIA GLASS LTD
		(c)	MODI GLASS
32.0	POLY CARBONATE SHEET WITH SUB-STRUCTURE SYSTEM PROVIDER	(a)	MCCOY ARCHITECTURAL SYSTEMS PVT. LTD.
		(b)	CITADEL ARCHITECTURAL SOLUTIONS PVT. LTD.
33.0	STAINLESS STEEL SINK WITH INTEGRATED DRAIN-BOARD		FRANKE
34.0	TOILET FIXTURES	(a)	KOHLER
		(b)	HINDWARE
		(c)	PARRYWARE
		(d)	NYCER
		(e)	CERA
35.0	TOILET FITTINGS	(a)	KOHLER
		(b)	JAQUAR
		(c)	ESCO
		(d)	ESS ESS
36.0	EXPANSION JOINT CONTROL	(a)	C/S ALLWAY BY MCCOY SILICONES LTD.

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

<u>SR.NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
37.0	SILICÓN SEALANT	(a)	MCCOY SILICONES LTD.
38.0	INSULATION	(a)	TWIGA- FOR GLASS WOOL INSULATION
		(b)	MINERAL ROCK FIBERS LTD.- FOR MINERAL FIBER WOOL INSULATION
		(c)	INSUBOARD" BY THE SUPREME INDUSTRIES LTD – FOR EXTRUDED POLYSTYRENE FOAM INSULATION

Notes:-

- 1) The above sub-vendor list is tentative & reference only. However sub-vendor list is subject to BHEL/end user approval without any commercial/delivery implication.
- 2) New subvendor if proposed by vendor during contract stage shall be subject to BHEL/end user approval without any commercial/delivery implication.

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
		VOLUME: II-B	
		SECTION: C	
		REV NO: 00	DATE:

DRAWING/DOCUMENT DISTRIBUTION SCHEDULE (TABLE-3)

Documents:	PEM-Engineering	CONSULTANT/ CUSTOMER	BHEL SITE OFFICE	CUSTOMER SITE OFFICE
Documents for approval (1 st submission and resubmission)	2+SOFT COPY	6+SOFT COPY	0	0
Documents for information (1 st submission and resubmission)	2+SOFT COPY	6+SOFT COPY	0	0
Schedules, diagrams, lists, tables, calculation, specifications and other documents	2+SOFT COPY	6+SOFT COPY	0	0
Final & as-built drawings				
Final as-built drawings and final approved documents	2+SOFT COPY+2CD	2+SOFT COPY+2CD	6+SOFT COPY+2CD	6+SOFT COPY+2CD
Final O&M manuals	2+SOFT COPY+2CD	2+SOFT COPY+2CD	6+SOFT COPY+2CD	6+SOFT COPY+2CD
Detailed project time schedules	2+SOFT COPY	2+SOFT COPY	2+SOFT COPY	2+SOFT COPY

Note:

- Quantity of prints may change during detailed engineering stage based on BHEL / Customer requirement. However the same will be adhered by the bidder without any delivery/commercial implication to BHEL.
- 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 (P&ID in A2 size, Layout (electrical/piping/equipment) in A1/A0, QAP/Data Sheet in A4 size).
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- 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.
- Bidder has 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-word (as applicable)/MS-Excel (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 / customer will also be submitted by the bidder without any delivery/commercial implication to BHEL.
 - P&IDs.
 - Equipment lay out.
 - Equipment Cable tray layout.
 - Equipment earthing layout.
 - Civil scope drawings.
 - Piping lay out drawing.
 - Valve schedule.
 - Instrument schedule.

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
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LIST OF MANDATORY SPARES TABLE-4

S.no.	Mandatory Spares	Total Quantity
1.	Spares for Horizontal Centrifugal Pumps	
1.1	Shaft	1 No.
1.2	Shaft Sleeve	2 Nos.
1.3	Impeller	1 No.
1.4	Impeller locking nut and bolt	4 Nos.
1.5	Impeller wear ring	4 Nos.
1.6	Casing wear ring	4 Nos.
1.7	Oil Seal	4 Nos.
1.8	Oil Deflector	3 Nos.
1.9	Oil Ring	3 Nos.
1.1	Gland Packing	400%
1.11	Lantern Ring	3 Nos.
1.12	Mech Seal Assembly	1 No.
1.13	Stationary/Carbon Packing and O" Ring for Mechanical Seal"	3 Sets
1.14	Oil Level Gauge	3 Nos.
1.15	Coupling	2 Nos.
1.16	Rubber Bush for Coupling	2 Nos.
1.17	O" Rings "	2 Sets
1.18	Suction Strainers Element	3 Nos.
1.19	Bearing for Pump Motor	2 Sets
2	Spares for Valves	
2.1	i) Manual Diaphragm valves	20% of total quantity used for each type and size with minimum no. two (2) for each type and size.
	ii) Auto Diaphragm valves	10% of total quantity used for each type and size with minimum no. two (2) for each type and size.
	iii) Spare Diaphragm for above	10% of total quantity used for each type and size with minimum no. two (2) for each type and size.
	iv) Diaphragm	10% of total quantity used for each type and size with minimum no. one (1) for each type and size.
2.2	i) Non return valves (NRV)	2 nos. of each size & type
	ii) Flaps for above NRV	2 nos. of each size
2.3	Gate/Globe/Ball valves/plug valve/needle valve/butterfly valve	
	i) Upto 4"	10% of total quantity used for each type and size with minimum no. two (2) for each type and size.
2.4	Electrical Items (415V motors) (Upto 30KW Rating)	
2.4.1	Terminal plates for motors upto 30kW for each rating	1 Lot for each type and rating
2.4.2	Terminal plates for motors abpve 30kW for each rating	1 Lot for each type and rating
2.4.3	Heaters	1 Lot for each type and rating
2.4.4	Greasing arrangements	1 Lot for each type and rating
2.4.5	Motor for each type and rating	10% of total quantity used for each type and size with minimum no. one (1) for each type and size.
2.4.6	Bearing (DE and NDE)	1 Lot for each type and rating
2.4.7	End shield cover driving and non driving end	1 Lot for each type and rating
2.4.8	Cooling fan	1 Lot for each type and rating
2.4.9	Motor terminal block	1 Lot for each type and rating
2.4.10	Complete set of coupling	1 Lot for each type and rating
2.5	Spares for C&I	
2.5.1	Terminal Block	10% of total quantity used for each rating and type.
2.5.2	MCB	1 No of each type and rating
2.5.3	Relays interposing relay	10% or 2 nos of each type and model whichever is more
2.5.4	Cooling fan for power supply	10% or 2 nos of each type and model whichever is more

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2.5.5	Electrode for conductivity type level monitoring system	50% of population
2.5.6	Electronic card	10% or 2 nos of each type and model whichever is more
2.5.7	Lamps/LED for display unit	100%
2.5.8	Transmitters/ Gauges/Switches etc. along with relevant accessories	10% of total or at least two (2) (whichever is higher) for each type along with accessories.
2.5.9	Electronic card/PCB's for each type and model and model of transmitter	10% of each type, range and immersion length, Minimum 5 nos.
2.5.10	Temperature Element (RTD/Thermo-couple) with thermowell	10% of each type, range and immersion length, Minimum 5 nos.
2.5.11	Process actuated switch devices including all t type of pressure, differential pressure, flow, temperature, differential temperature, level switch devices	10% or 1 no of each type and model whichever is more
2.5.12	Level transmitter (displacer type)	
2.5.12.1	Electronic cards/PCB's of level transmitter	10% or 1 no of each type and model whichever is more
2.5.12.2	Electronic water level indicator	10% or 2 nos of each type and model whichever is more
2.5.13	Switches (pressure, DP, Level, Flow, Temperatur, etc)	10% or 1 no of each type and model and range whichever is more
2.5.14	Process connection (for impulse piping/tubing, sampling piping/tubing and air supply piping as applicable)	
2.5.14.1	Valves of all types and models	10% or 2 nos of each type, class, size and model whichever is more.
2.5.14.2	2 way, 3 way, 5 way valve manifold	10% or 2 nos of each type, class, size and model whichever is more.
2.5.14.3	Fittings	10 nos of each type
2.5.14.4	Purge meters	10% or 2 nos of each model whichever is more.
2.5.14.5	Filter regulators	10% or 2 nos of each model whichever is more.
2.5.14.6	Impulse pipe and tubing of all type	20 meters of each type and size
2.5.14.7	Impulse line root valve	10% of total quantity used or 4 nos whichever is more for each type and rating.
2.5.14.8	SS tube	40 meters of each type and size
2.5.14.9	Fittings for SS tube	40 meters of each type and size
2.5.15	INSTRUMENTATION CABLE, INTERNAL WIRING AND ELECTRICAL FIELD	
2.5.15.1	Prefabricated cable of each type	10% of insulated quantity
2.5.15.2	Prefabricated cable connector	10% of 1 No of each type and model whichever is more
2.5.15.3	Other cables	10% of each type, pair and size of actual insulated quantity.
2.5.16	ELECTRICAL ACTUATORS	
2.5.16.1	Actuators	10% or 1 No of each type, model and rating, whichever is more.
2.5.16.2	Power unit for modulating actuator	10% or 2 Nos of each type whichever is more.
2.5.16.3	DC-DC unit/power pack units	10% or 2 Nos of each type whichever is more.
2.5.16.4	Electronic cards	10% or 5 Nos of each type whichever is more.

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2.5.16.5	Brake assembly	10% or 2 Nos of each type whichever is more.
2.5.16.6	Brake coils	10% or 2 Nos of each type whichever is more.
2.5.16.7	Position feedback transmitters	10% or 2 Nos of each type whichever is more.
2.5.16.8	Control unit	10% or 2 Nos of each type whichever is more.
2.5.16.9	Torque and limit switch assembly of each unit	10% or 2 Nos of each type whichever is more.
2.5.16.10	O-ring	1 set of each size
2.5.17	Pressure gauge, temperature gauge, isolating valve of instrument, solenoid valve, rotameter, etc	10% of total quantity of each items and type/rating used in the system or minimum 1 No whichever is higher.
2.5.18	Annunciation system	
2.5.18.1	Each type of PCB	1 No of each type
2.5.18.2	Lamp box with facia and lamps (LED type)	5 nos
2.5.18.3	Hooter	1 No.
2.5.19	Rader type level transmitter	
2.5.19.1	Receiver	10% or 1 No of each type of transmitter/receiver.
2.5.19.2	Electronic card	10% or 1 No of each type electronic card
2.5.20	Control panel and local remote control desk	
2.5.20.1	Recorder	1 no for each type and model.
2.5.20.2	Bar graph indicator	10% of total quantity used in the system or minimum one (1) no whichever is higher for each type and model.
2.5.20.3	Digital indicator	10% of total quantity used in the system or minimum one (1) no whichever is higher for each type and model.
2.5.20.4	Mosaic/conventional type push button station	10% of total quantity used in the system or minimum two (2) nos whichever is higher for each type and model.
2.5.20.5	Mosaic type push button station with LED indication	10% of total quantity used in the system or minimum two (2) nos whichever is higher for each type and model.
2.5.20.6	Mosaic type LED indication station	10% of total quantity used in the system or minimum two (2) nos whichever is higher for each type and model.
2.5.20.7	Semaphore indicator	Tow nos of each type
2.5.21	Annunciation system	
2.5.21.1	Each type of PCB (for non PLC driven system)	1 No each
2.5.21.2	Lamp box with facia and lamps (LED type)	10% or 2 Nos whichever is higher.
2.5.21.3	Hooter	1 no.
2.5.22	Mandatory spares not covered under sl no 2.5	10% electronic modules/cards or any other electronic components required for annunciation system.

Note: Only applicable items shall be considered. Applicable items are those which are installed in the system.

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PAINTING SPECIFICATION

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15.0 PAINING

15.1 GENERAL

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner.

All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner.

All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat.

Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in

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windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment.

Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use.

Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel.

The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished.

The Contractor shall select shop primer for steel and iron surfaces, which will have a continuous operating temperature below 35°C, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C.

The Owner/Engineer shall submit the colour scheme during execution of contract for approval.

15.2 PREPARATION

Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying.

Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed.

The priming coat shall be applied without delay.

15.3 DAMAGED PAINTWORK

Any damaged paintwork shall be made good as follows:

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15.3.1 The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.

15.3.2 A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.

15.3.3 The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming

15.4 **PAINTING SYSTEMS**

The requirements for the Dry Film Thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.

15.4.1 Surfaces subject to Weathering

All surfaces shall have a minimum of four coats of paint made up as follows:

- | | | | |
|-----|---------------------------|---|------------------------|
| (a) | Primer coat | : | 35 micron DFT |
| (b) | Tie coat | : | 35 micron DFT |
| (c) | Finishing coat (Two Nos.) | : | 35 micron DFT per coat |
| (d) | The total minimum DFT | : | 140 micron |

15.4.2 Surfaces Inside Buildings

All surfaces shall have a minimum of three coats of paint made up as follows:

- | | | | |
|-----|---------------------------|---|------------------------|
| (a) | Primer coat | : | 35 micron DFT |
| (b) | Tie coat | : | 35 micron DFT |
| (c) | Finishing coat (Two Nos.) | : | 25 micron DFT per coat |
| (d) | The total minimum DFT | : | 120 micron |

The Contractor shall select the type and colour of primer & finish coat after approval by the Owner.

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16.0 COLOUR CO-ORDINATION & FINISH

- 16.1 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.
- 16.2 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification.
- 16.3 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned.
- 16.4 Final colours and finishes shall be to the Approval of the Engineer.

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QUALITY PLAN

MANUFACTURER'S		STANDARD QUALITY PLAN				PROJECT		1X660MW BHUSAWAL TPS-UNIT:6		
NAME & ADDRESS :										
ITEM : CW CHEMICAL TREATMENT.		QP.NO :		PE-QP-410-156-A001		PACKAGE				
		REV. :		0		CONTRACT NO.				
		DATE :				COTRACTOR				
		PAGE :		1 OF 10						
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY**	REMARKS
1	2	3	4	5	6	7	8	9	D*	10
1.0	WELDER'S QUALIFICATION									
1.1	WELDING PROCEDURE SPECIFICATION (WPS)	CORRECTNESS	MA	SCRUTINY	100%	ASME IX	ASME IX	QW 482	P	V V
1.2	WELDER PERFORMANCE QUALIFICATION RECORD (PQR)	WELD SOUNDNESS	MA	PHYSICAL TEST	ASME IX	ASME IX	ASME IX	QW 483 QW 484	P	V V
2.0	TANKS, BOTTOM ENDS, FLANGES									
2.1	RAW MATERIAL :									
2.1.1	PLATE	CHEMICAL & PHY. PROPERTIES	MA	CHEMICAL & PHY. TEST	1/PLATE	APPD. DWG/DATA SHEET	APPD. DWG/DATA SHEET	MFG.TC/LAB REPORT	P	V V
		INTERGRANULAR CORROSION TEST	MI	CORROSION TEST	1/PLATE	APPD. DWG/DATA SHEET	APPD. DWG/DATA SHEET			
2.1.2	PIPE FOR NOZZLE	CHEMICAL & PHY. PROPERTIES	MA	CHEMICAL & PHY. TEST	1/HEAT/SIZE	APPD. DWG/DATA SHEET	APPD. DWG/DATA SHEET	MFG.TC/LAB REPORT	P	V V
		MICRO	MI	GRAIN	1/HEAT/SIZE	FOR HEAT	FOR HEAT	DO	P	V V
		STRUCTURE		STRUCTURE		TREATMENT	TREATMENT	DO	P	V V
		CORROSSION TEST	MI	CORROSION TEST	1/HEAT/SIZE	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'	DO	P	V V
		HYDRO TEST	NA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG. TC/IR	P	V V
	FOR BHEL	LEGEND :						DOC NO.		
			* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.				FOR CUSTOMER USE			
			** M : MANUFACUTRER/SUB-CONTRACTOR							
			C : CONTRACTOR/NOMINATED INSPECTION AGENCY				N: OWNER			
MANUFACTURER/ SUB CONTRACTOR	CONTRACTOR	INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION								
SIGNATURE		AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".				REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY			

MANUFACTURER'S NAME & ADDRESS :		STANDARD QUALITY PLAN						PROJECT		1X660MW BHUSAWAL TPS-UNIT:6	
		ITEM : CW CHEMICAL TREATMENT.		QP.NO :		PE-QP-410-156-A001		PACKAGE			
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S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY**	
1	2	3	4	5	6	7	8	9	D*	M	C N
3.3	COMPLETE UNIT WITH MOTOR	PERFORMANCE IN WATER FILL TANK	MA								
		- VIBRATION		MEASUREMENT	100%	APPD.DWG/DATA SHEET	APPD.DWG/DATA SHEET	MFG.TC		P	V V
		- WOBBLING		VISUAL	100%						
		- POWER CONSUMPTION		MEASUREMENT	100%	APPD.DWG/DATA SHEET	APPD.DWG/DATA SHEET	MFG.TC			
		OR CURRENT DRAWN									
4.0	MOTORS :										
		ROUTINE & TYPE TEST,	MA	VERIFICATION OF	100% FOR	APPD.DATA SHEET	APPD.DATA SHEET	MFG.TC/LAB		P	V V
		DEGREE OF		TEST CERTIFICATES	ROUTINE TEST			REPORT			
		PROTECTION			& 1/SIZE FOR						SHALL BE AS PER APPD.LIST
					TYPE TEST						
					& DEGREE OF						
					PROTECTION						
5.0	METERING PUMP & PRESSURE RELIEF VALVE :										
	(PUMPS SHALL BE PROCURED FROM BHEL APPD.SOURCE)										
5.1	RAW MATERIAL :										
5.1.1	WETTED PARTS	CHEMICAL & PHY. PROPERTIES	MA	CHEMICAL. & MECH. TEST	1/BAR	APPD.DWG./DATA SHEET	APPD.DWG./DATA SHEET	MFG.TC/LAB REPORT		P	V V
		SURFACE TEST		UT ON BAR>25 MM DIA	100%	ASTM A 388	REF. NOTE # 1	MFG.TC/LAB REPORT			
				DP ON M/C SURFACE	100%	ASME - E - 165	NO SURFACE DEFECTS	MFG.TC/LAB REPORT			
		FOR BHEL	LEGEND :								
			* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.				FOR CUSTOMER USE				
			** M : MANUFACTURER/SUB-CONTRACTOR								
			C : CONTRACTOR/NOMINATED INSPECTION AGENCY			N: OWNER					
MANUFACTURER/ SUB CONTRACTOR		CONTRACTOR		INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION							
SIGNATURE		AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".				REVIEWED BY		NAME & SIGN OF APPROVING AUTHORITY			

[illegible]

MANUFACTURER'S		STANDARD QUALITY PLAN				PROJECT		1X660MW BHUSAWAL TPS-UNIT:6		
NAME & ADDRESS :										
ITEM : CW CHEMICAL TREATMENT.		QP.NO :		PE-QP-410-156-A001		PACKAGE				
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S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY**	REMARKS
1	2	3	4	5	6	7	8	9	M C N	11
8.0	STRAINERS :								D*	
8.1	RAW MATERIAL FOR BODY	PHY.& CHEM. PROPERTIES	MA	PHY. & CHEM.TEST	1/BAR/SIZE	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	LAB REPORT	P V V	
8.2	SCREEN	CHEMICAL	MA	CHEMICAL	1/SIZE	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	MFG.TC/LAB REPORT	P V V	
		MESH SIZE	MA	MEASUREMENT	1/SIZE	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	MFG.TC/LAB REPORT		
8.3	FINAL INSPECTION	DIMENSIONS	MA	MEASUREMENT	100%	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	MFG.TC	P V V	
		LEAKAGE		HYDRO TEST	100%	APPD.DWG./DATA SHEETS	NO LEAKAGE	MFG.TC		
9.0	PIPE (SEAMLESS)									
	MATERIAL (REF. NOTE -2)	CHEMICAL	MA	CHEMICAL	1/HEAT/SIZE	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	MFG.TC/LAB REPORT	P V V	IDENTIFICATION BY BHEL
		MENICAL TEST		MENICAL TEST	1/HEAT/SIZE	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	MFG.TC/LAB REPORT	P V V	\$ REFER NOTE-6
		MICRO STRUCTURE		GRAINS STRUCTURE	1/HEAT/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT	P V V	
		INTERGRANULAR		CORROSION TEST	1/HEAT/SIZE	ASTM A 262 PR 'E'	ASTM A 262 PR 'E'	MFG.TC/LAB REPORT	P V V	
		CORROSION TEST							P V V	
		HTDRO TEST		LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG.TC/LAB REPORT	P W V	
		FOR BHEL	LEGEND :					DOC NO.		
			* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY				FOR CUSTOMER USE			
			INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.							
			** M : MANUFACUTRER/SUB-CONTRACTOR							
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MANUFACTURER/ SUB CONTRACTOR		CONTRACTOR		INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION						
SIGNATURE		AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".				REVIEWED BY		NAME & SIGN OF APPROVING AUTHORITY		



MANUFACTURER'S		STANDARD QUALITY PLAN				PROJECT		1X660MW BHUSAWAL TPS-UNIT:6		
NAME & ADDRESS :										
ITEM : CW CHEMICAL TREATMENT.		QP.NO :		PE-QP-410-156-A001		PACKAGE				
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S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY**	REMARKS
1	2	3	4	5	6	7	8	9	D*	11
12.0	LEVEL SWITCH :									
12.1	MAT. FOR WETTED	CHEM.PROPERTIES	MA	CHEM.TEST	1/HEATR	APPD.DATA SHEET/DWG.	APPD.DATA SHEET/DWG.	MFG.TC/LAB REPORT	P	V V
	PARTS INCLUDING									
	FLOAT									
12.2	PERFORMANCE	FUNCTIONAL	MA	VISUAL	100%	APPD.DATA SHEET/DWG.	APPD.DATA SHEET/DWG.	MFG.TC	P	V V
		IR-HV-IR		ELECTRICAL		DO	DO	MFG.TC		
		DIMENSIONS		MEASUREMENT		DO	DO	MFG.TC		
		DEGREE OF PROTEC.		TYPE TEST		DO	DO	MFG.TC/LAB REPORT		
13.0	DIFF PRESSURE SWITCH									
	MATERIAL FOR WETTED		MA	VERIFICATION		APPD.DATA SHEET/DWG.	APPD.DATA SHEET/DWG.	MFG COMPLIANCE	P	V V
								CERTIFICATE		
	PARTS PERFORMANCE	CALIBRATION	MA	PERFORMANCE	100%	APPD.DATA SHEET/DWG.	APPD.DATA SHEET/DWG.	MFG TC	P	V V
14.0	CONTROL PANEL :	DIMENSIONS,	MA	MEASUREMENT,	100%	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	LAB REPROT	P	W V
		CONTINUITY, IR-HV-IR		ELECTRICAL						
		FUNCTIONAL, DEGREE .								
		OF PROT, VERIFICATION								
		OF MAKE, RATING OF								
		COMPONENTS								
		SIMULATION TEST \$\$								
		PAINT SHADES, THICK								
		ADHESION								
15.0	COMPLETE SKID	DIMENSIONS &	CR	MEASUREMENT	-100%	APPD.DWG./	APPD.DWG./	INSPECTION	P	W W
	ASSEMBLY :	ORIENTATION				DATA SHEET	DATA SHEET	REPORT		
		LEAKAGE, CHECK		VISUAL &		DISCH.PIPING - 1.5 x	NO LEAKAGE			
		ON WELDMENTS		HYDRO TEST		DISCH.PR. OF PUMP	NO LEAKAGE			
		FUNCTIONAL TEST\$\$				SUCTION PIPING -3 KG/CM2				
		LEGEND :						DOC NO.		
		* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY				FOR CUSTOMER USE				
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		** M : MANUFACUTRER/SUB-CONTRACTOR								
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MANUFACTURER/	CONTRACTOR									
SUB CONTRACTOR		INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION								
SIGNATURE		AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".				REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY			



MANUFACTURER'S		STANDARD QUALITY PLAN				PROJECT		1X660MW BHUSAWAL TPS-UNIT:6		
NAME & ADDRESS :										
ITEM : CW CHEMICAL TREATMENT.		QP.NO :		PE-QP-410-156-A001		PACKAGE				
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S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY**	REMARKS
1	2	3	4	5	6	7	8	9	D*	10
		PAINTING	MA	VISUAL & MEASUREMENT	-100%	APPD DWN/PAINTING	APPD DWN/PAINTING	INSPECTION	P	V V
						SCHEME	SCHEME	REPORT		
		PACKING	MA	VISUAL	-100%	BHEL SPEC	BHEL SPEC	INSPECTION	P	V
				DFT	-100%	BHEL SPEC	BHEL SPEC	REPORT		
			LEGEND :					DOC NO.		
			* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY				FOR CUSTOMER USE			
			INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.							
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MANUFACTURER/	CONTRACTOR									
SUB CONTRACTOR		INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION								
SIGNATURE		AS APPROPRIATE, "CHP" NTPC SHALL IDENTIFIED IN COLUMN "N".				REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY			

MANUFACTURER'S		STANDARD QUALITY PLAN				PROJECT		1X660MW BHUSAWAL TPS-UNIT:6	
NAME & ADDRESS :									
ITEM		: CW CHEMICAL TREATMENT.		QP.NO :		PE-QP-410-156-A001		PACKAGE :	
				REV. :		0		CONTRACT NO. :	
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P - PERFORMANCE		W - WITNESS							
V - VARIFICATION		MA - MAJOR		MI - MINOR					
CR - CRITICAL		CHP--D :CUSTOMER(BHEL/OWNER) HOLD POINT							
NOTE:1 ; WHEN BACK WALL ECHO IS SET TO 100% OF FSH IN SOUND AREA, DEFECT ECHO SHALL NOT EXCEED 20% OF FSH. MAX BACH WALL ECHO IS 20% OF FSH. TOTAL NO OF DEFECTS SHALL BE MAX. 5 NO IN ONE METER LENGTH. DISTANCE BETWEEN TWO DEFECTS SAHLLA BE 3 MIN TIMES THE DIA OF BAR. NOTE: 2 ; NDT REQUIREMENT ON THE PIPING WELDING SHALL BE AS a) ON BUTT WELD 25% FP AND 25% RT FOR PUMP SUCITON SIDE AND FOR PUMP DISCHARGE SIDE 100% RT AND 100% DP TEST. b) 100% DP ON FILLER WELD JOINTS NORMS SHALL BE AS PER ASME SECTION VIII. NOTE-3: LEVEL GAUGE, PRESSURE GAUGE , LEVEL SWITCH, CONTROL PANEL & ALL INSTRUMENTS SHALL BE PROCURED FROM OWNER/BHEL APPROVED MAKE. NOTE 4; SIMULATION TEST WILL BER CARRIED OUT WITH 24 VDC SUPPLY TO CONTROL PANEL AT THE CONTROL PANEL MANUGACTURER'S PLACE. NOTE 5 FUNTIONAL TEST WILL BE CARRIED OUT WOTHOUT 24 VDC I.e, ONLY CONTINUITY TEST WILL BE SHOWN AT VENDOR WORK. NOTE 6 FOR PIPES PURCHASED DIRECTLY FROM MANUFACTURER'S OR AUTHORISED DEALERS, APART FROM TC REVIEW, CHECK WILL BE AS PER CLASS 2.1.2 AND 10.0; HOWEVER FOR HYDRAULIC TEST MANUFACTURER TC SHALL BE REVIEWED . IN CASE ON IMPORTED PIPES PURCHASED FROM OPER MARKET CHECK TESTION AS PER CLAUSE 2.1.2 AND 10.0 (INCLUDING HYDRAULIC TEST) SHALL BE CARRIED OUT ON EACH LENGTH ;P HYDRAULIC TEST SHALL BE WITNESS BY BHEL. NOTE 7 FOR RAW MATERIAL (BARS/PIPES/CASTINGS/FORGINGS) WHERE HEAT TREATMENT ARE CARRIED OUT BY MATERIAL OPRODUCERS ON BULK QUANTITIES, THEIR TEAT CERTIFICATE SHALL BE REVIEWD (EXCEPT TIME TEMPERATURE CHART).									
		FOR BHEL		LEGEND :				DOC NO.	
				* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY		FOR CUSTOMER USE			
				INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.					
				** M : MANUFACUTRER/SUB-CONTRACTOR					
				C : CONTRACTOR/NOMINATED INSPECTION AGENCY		N: OWNER			
MANUFACTURER/		CONTRACTOR							
SUB CONTRACTOR				INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION					
SIGNATURE				AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".		REVIEWED BY		NAME & SIGN OF APPROVING AUTHORITY	



	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
		VOLUME: II-B	
		SECTION: C	
		REV NO: 00	DATE:

DATA SHEET-A

Sl no.	Description	Parameters
1.0	SULPHURIC ACID STORAGE TANK	
1.1	Numbers	Two(2) [1W+1S]
1.2	Type and location	Horizontal cylindrical with dished ends. Outdoor.
1.3	Type of fluid to be handled	98 % Sulphuric Acid.
1.4	Effective capacity, in m3	Minimum 55 m3 (each) or storage requirement for 15 days operation in full load.
1.5	Minimum Free Board	300 mm
1.6	Material of Construction	
1.6.1	Shell	Mild steel as per IS 2062 or ASTM A 516 Gr.70.
1.6.2	Dished Ends	Mild steel as per IS 2062 or ASTM A 516 Gr.70.
1.7	Design Temperature	80 Deg.C
1.7	Dimensions (diameter, length & thickness)	ASME SEC VIII DIV I /IS 2825. Thickness of each acid storage tank will be 10 mm (minimum).
1.8	Instruments	As per P& ID and system requirement.
1.9	Manhole in each tank	2 nos each of 600 mm (min)
1.10	Accessories for each tank	Operating platform, ladders etc
2.0	SULPHURIC ACID UNLOADING PUMPS	
2.1	Number	Two (2) [1W+1S].
2.2	Location	Outdoor.
2.3	Fluid to be handled	98% w/w Commercial Sulphuric Acid.
2.4	Service	To unload Concentrated Sulphuric Acid from Tanker to Sulphuric Acid Storage Tank.
2.5	Type of Pump	Horizontal Centrifugal Non Clog type
2.6	Design standard	As per IS-5659 /IS-5120/ or equivalent.
2.7	Rated Capacity, in m3/hr	10 m3/hr
2.8	Range of operation	20 % - 120 %.
2.9	Head to be developed at rated capacity	10 mlc min or as per system requirement.
2.10	Accessories	As per tender specification, P&ID and system requirement.
2.11	Material of construction	
2.11.1	Casing	Alloy-20.
2.11.2	Impeller	Alloy-20.
2.11.3	Shaft	EN-8 to BS-970.
2.11.4	Strainer	Poly propylene (2X100 %, 50 BS).
2.12	Type of drive	Electrical Motor
2.13	Criteria of selection of drive motor	Minimum 15 % margin over BKW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
2.14	Rated speed (RPM)	1500 (Sync.) max
2.15	Voltage, Phase & Frequency (± % Variation)	415 V (+10%), 3 Phase,50 HZ (+10 to -10%).
2.16	HDPE Hose	Two (2) numbers, each min 80 NB and 20 m long type-2 HDPE hose as per IS-7654/1989 with isolation hose.
2.17	Accessories required for each pump	Coupling guard, drain plug, vent valve, suction hoses, isolation valves, Y-type strainers, pressure gauges, pulsation dampener.
2.18	Foundation bolts	Alloy-20.
3.0	SULPHURIC ACID DOSING PUMPS	
3.1	Number	Two (2) [1W+1S].
3.2	Fluid to be handled	98% w/w sulphuric acid.
3.3	Service	To inject concentrated sulphuric acid into CW Fore bay.
3.4	Duty	Continuous and to be suitable for parallel Operation.
3.5	Type of Pump	Positive displacement, constant speed, variable stroke and plunger operated reciprocating type.
3.6	Rated Capacity, in LPH	600 LPH each.
3.7	Facility for Capacity Adjustment	Local manual through Micrometer Dial and remote manual from LCP.
3.8	Range of Capacity Adjustment	0 % - 100 %.
3.9	Head to be developed at rated capacity	As per system requirement. However it shall not be less than 15 mlc
3.10	Accessories	As per tender specification, P&ID and system requirement.
3.11	Material of construction	
3.11.1	Housing	Alloy-20.

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3.11.2	Pump head	Alloy-20.
3.11.3	Plunger	Alloy-20.
3.11.4	Worm	Manganese Bronze / Cast Iron.
3.11.5	Worm Wheel	Manganese Bronze / Cast Iron.
3.11.6	Shafts (worm)	Hardened Steel (EN 19 / ASTM A 276 Gr.410).
3.11.7	Base plate	MS.
3.11.8	Foundation bolts	Alloy-20.
3.11.9	Type of drive	Electrical Motor
3.11.10	Criteria of selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
3.11.11	Rated speed (RPM)	1500 (Sync.) max.
4.0	SULFURIC ACID DAY TANK	
4.1	Numbers To be provided	Two (2) [1W+1S]
4.2	Type	Vertical cylindrical with dished ends with top cover with opening with hinge on cover.
4.4	Effective capacity, in m ³	Total effective capacity of each tank shall be not be less than 7.5 cum.
4.5	Type of fluid to be handled	98 % Sulphuric Acid.
4.6	Material of Construction	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
4.7	Thickness, in mm	Not less than 10.0
4.8	Accessories for each tank	Operating platform, ladders etc.
5.0	SCALE INHIBITOR TANK	
5.1	Numbers To be provided	Two (2) numbers
5.2	Type for each Tank	Vertical cylindrical with dished ends with top cover with opening with hinge on cover.
5.3	Type of fluid to be handled	Commercial Scale Inhibitor Solution.
5.4	Effective capacity of each tank, m ³	Total effective capacity of each tank shall be not be less than 3.0 cum.
5.5	Minimum Free Board, in mm	300
5.6	Material of Construction	SS-316
5.7	Thickness, in mm	Not less than 5
5.8	Accessories for each tank	Charging platform, ladders, Hand pump with flexible hose etc.
6.0	SCALE INHIBITOR DOSING PUMPS	
6.1	Number	Two (2) [1W+1S]
6.2	Location	Indoor
6.3	Capacity	40 LPH (each).
6.4	Service	To inject Scale Inhibitor Solution into CW forebay.
6.5	Type of Pump	Positive displacement, constant speed, variable stroke and plunger operated reciprocating type.
6.6	Facility for Capacity Adjustment	Local manual through Micrometer Dial and remote manual from LCP.
6.7	Range of Capacity Adjustment	0 % - 100 %.
6.8	Suction Condition	Flooded.
6.9	Head to be developed at rated capacity	As per system requirement. However it shall not be less than 15 mlc
6.10	Material of construction	
6.10.1	Housing	SS-316.
6.10.2	Pump head	SS-316.
6.10.3	Plunger	SS-316.
6.10.4	Worm	Manganese Bronze / Cast Iron.
6.10.5	Worm Wheel	Manganese Bronze / Cast Iron.
6.10.6	Shafts (worm)	Hardened Steel (EN 19 / ASTM A 276 Gr.410).
6.10.7	Base plate	MS.
6.11	Type of drive	Electrical Motor
6.12	Criteria of selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
6.13	Rated speed (RPM)	1500 (Sync.) maximum.
6.14	Accessories	As per tender specification, P&ID and system requirement.
7.0	CORROSION INHIBITOR TANKS	
7.1	Numbers To be provided	Two (2) numbers
7.2	Type for each Tank	Vertical cylindrical with dished ends with top cover with opening with hinge on cover.
7.3	Type of fluid to be handled	Commercial Scale Inhibitor Solution.

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7.4	Effective capacity of each tank, m ³	Total effective capacity of each tank shall be not be less than 3.0 cum.
7.5	Minimum Free Board, in mm	300
7.6	Material of Construction	SS-316
7.7	Thickness, in mm	Not less than 5
7.8	Accessories for each tank	Charging platform, ladders, Hand pump with flexible hose etc.
8.0	CORROSION INHIBITOR DOSING PUMPS	
8.1	Number	Two (2) [1W+1S]
8.2	Location	Indoor
8.3	Capacity	40 LPH (each).
8.4	Service	To inject Scale Inhibitor Solution into CW forebay.
8.5	Type of Pump	Positive displacement, constant speed, variable stroke and plunger operated reciprocating type.
8.6	Facility for Capacity Adjustment	Local manual through Micrometer Dial and remote manual from LCP.
8.7	Range of Capacity Adjustment	0 % - 100 %.
8.8	Suction Condition	Flooded.
8.9	Head to be developed at rated capacity	As per system requirement. However it shall not be less than 15 mlc
8.10	Material of construction	
8.10.1	Housing	SS-316.
8.10.2	Pump head	SS-316.
8.10.3	Plunger	SS-316.
8.10.4	Worm	Manganese Bronze / Cast Iron.
8.10.5	Worm Wheel	Manganese Bronze / Cast Iron.
8.10.6	Shafts (worm)	Hardened Steel (EN 19 / ASTM A 276 Gr.410).
8.10.7	Base plate	MS.
8.11	Type of drive	Electrical Motor
8.12	Criteria of selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
8.13	Rated speed (RPM)	1500 (Sync.) maximum.
8.14	Accessories	As per tender specification, P&ID and system requirement.
6.0	BIOCIDE TANKS	
6.1	Numbers To be provided	Two (2) [1W+1S]
6.2	Type for each Tank	Vertical cylindrical with dished ends with top cover with opening with hinge on cover.
6.3	Type of fluid to be handled	Commercial Biocide Solution.
6.4	Effective capacity of each tank, m ³	Total effective capacity of each tank shall be not be less than 3.0 cum.
6.5	Minimum Free Board, in mm	300
6.6	Material of Construction	SS-316
6.7	Thickness, in mm	Not less than 5
6.8	Accessories for each tank	Charging platform, ladders, Hand pump with flexible hose etc.
7.0	BIOCIDE INJECTION PUMPS	
7.1	Number	Two (2) [1W+1S]
7.2	Location	Indoor
7.3	Capacity	450 LPH (each).
7.4	Service	Commercial Biocide Solution.
7.5	Type of Pump	Positive displacement, constant speed, variable stroke and plunger operated reciprocating type.
7.6	Facility for Capacity adjustment	Local manual through Micrometer Dial and remote manual from LCP.
7.7	Range of Capacity adjustment	0 % - 100 %.
7.8	Suction Condition	Flooded.
7.9	Head to be developed at rated capacity	As per system requirement. However it shall not be less than 15 mlc
7.10	Material of construction	
7.10.1	Housing	SS-316.

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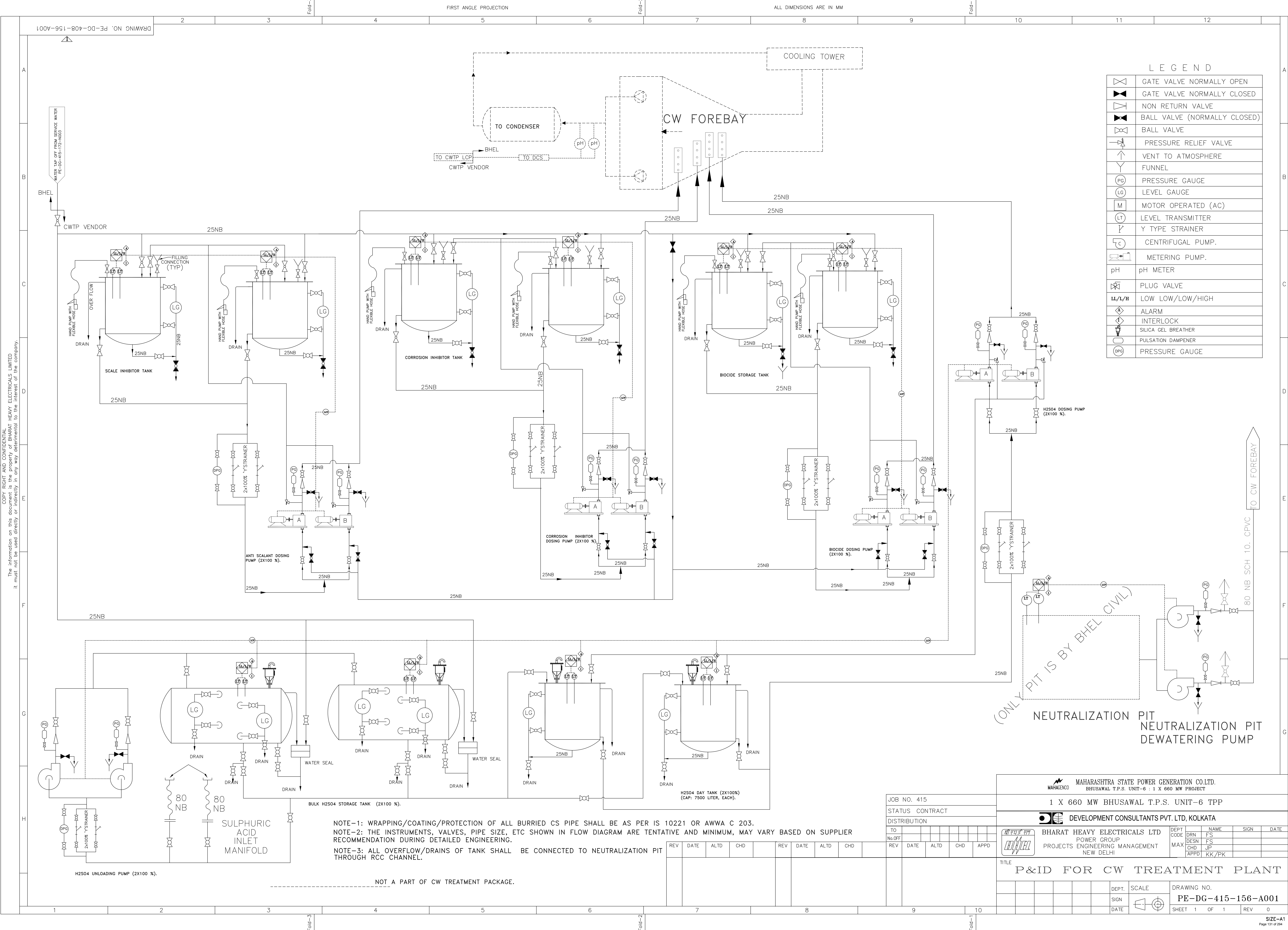
7.10.2	Pump head	SS-316.
7.10.3	Plunger	SS-316.
7.10.4	Worm	Manganese Bronze / Cast Iron.
7.10.5	Worm Wheel	Manganese Bronze / Cast Iron.
7.10.6	Shafts (worm)	Hardened Steel (EN 19/ASTM A 276 Gr.410).
7.10.7	Base plate	MS.
7.10.8	Type of drive	Electrical Motor
7.10.9	Criteria of selection of drive motor	As per system requirement.
7.10.10	Rated speed (RPM)	1500 (Sync.) maximum.
7.11	Accessories	As per tender specification, P&ID and system requirement.
8.0	NEUTRALIZATION PIT (CIVIL WORK BY BHEL CIVIL)	
8.1	Quantity	One number.
8.2	Capacity	40 CuM.
8.3	MOC	RCC with acid alkali protection.
9.0	NUTRALIZATION PIT DEWATERING PUMP	
9.1	Quantity	Two (2) nos. (1W+1S).
9.2	Capacity & Head	10 Cum/Hr & 1 Kg/cm ² (g).
9.3	Type	Horizontal Centrifugal.
9.4	Motor rating	Vendor Design specific.
9.5	Material of Construction	Casing/Cover – PP, Pump shaft– EN8, Impeller – PP. Base Plate-MS-FRP, Fastener- SS 316L.
10.0	PIPE, VALVES, STRAINER AND DIFFUSER	
10.1	Pipe MOC	For H ₂ SO ₄ application-Seamless Carbon Steel pipe to ASTM A53 Gr. B /IS: 1239 Part- I, Heavy grade. For Scale & Corrosion Inhibitor and Biocide application-Stainless Steel to ASTM 312 Type 316 welded, schedule-10.
10.2	Valves	For H ₂ SO ₄ application-CPVC, PN10. For Scale & Corrosion Inhibitor and Biocide application-SS 316 PN10.
10.3	Strainer	For H ₂ SO ₄ application-CPVC (50 BS). For Scale & Corrosion Inhibitor and Biocide application- Stainless Steel to ASTM 312 Type 316 welded, schedule-10.
10.4	Diffuser	SS-316 for all application.
11.0	Safety Equipment	Four sets of safety equipment comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided. Two personnel water drench shower and eye bath shall be provided.

NOTES:

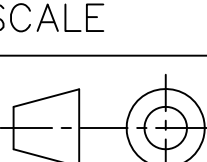
1. Noise level of all equipment shall be within 85 dbA and vibration level shall be within 30 μ .

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P&ID



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		MAHARASHTRA STATE POWER GENERATION CO. LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT															
1 X 660 MW BHUSAWAL T.P.S. UNIT-6 TPP																	
		DESIGN CONSULTANTS PVT. LTD, KOLKATA															
		BHARAT HEAVY ELECTRICALS LTD				DEPT CODE		NAME		SIGN		DATE					
		POWER GROUP				DRN		FS									
		PROJECTS ENGINEERING MANAGEMENT				MAX		DESN		FS							
		NEW DELHI						CHD		JP							
								APPD		KK/PK							
TITLE																	
P&ID FOR CW TREATMENT PLANT																	
						DEPT.	SCALE		DRAWING NO.								
						SIGN			PE-DG-415-156-A001								
					DATE	SHEET 1 OF 1 REV 0											

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
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KEY PLAN

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SECTION – C2

(SPECIFIC TECHNICAL REQUIREMENTS FOR ELECTRICAL)

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
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ELECTRICAL EQUIPMENT SPECIFICATION



TITLE:

**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
CW TREATMENT PLANT**

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION: **C**REV NO. : **00** DATE: 23/07/2019

SHEET: 1 OF 1

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for CW TREATMENT PLANT SYSTEM.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL.
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc. shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “both end equipment in vendor’s scope” shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this, the bidder shall furnish two signed and stamped copies of the following:

- a) A copy of this sheet “Electrical Equipment Specification for CW TREATMENT Plant and sheet Electrical scope between BHEL and Vendor” with bidder’s signature and company stamp.
- b) Electrical load requirement in the load data format.

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc. is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures:

- a) Electrical scope between BHEL & vendor (~~Annexure I~~)
- b) Technical specification for motors ~~DG/BSL U-6/2011/T-1~~
- c) Datasheets ~~along with Annexure I~~
- d) Conduit & Pipes specification & constructional details of cables.
- e) Quality plan for motors.
- f) Electrical Load data format (~~Annexure II~~)
- g) BHEL cable listing format (~~Annexure III~~)

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ELECTRICAL LOAD FORMAT

[illegible]

NOTES:

1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)

	LOAD DATA (ELECTRICAL)	JOB NO.	415	ORIGINATING AGENCY		PEM (ELECTRICAL)	
		PROJECT TITLE	1X660MW BHUSAWAL TPS	NAME		DATA FILLED UP ON	
		SYSTEM / S	CW TREATMENT PLANT	SIGN.		DATA ENTERED ON	
		DEPTT. / SECTION	ELECTRICAL	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

ANNEXURE - II

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
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ELECTRICAL SCOPE FOR VENDOR AND BHEL

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGE: CW TREATMENT PLANT****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 1 X 660MW BHUSAWAL TPP**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	1. 415 V AC (3 Phase, 4 Wire) /240 V AC supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor. 4. Laying of cables by BHEL except for cabling in vendor scope.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGE: CW TREATMENT PLANT****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 1 X 660MW BHUSAWAL TPP**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable (excluding power cables) in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

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SECTION – C3

(SPECIFIC TECHNICAL REQUIREMENTS FOR C&I)

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
Specific Technical Requirements (C&I): 1) The control of CW Treatment Plant shall be through Relay based control system with annunciation/colour mimic/lamp/push buttons/ammeters/necessary indication status etc. Pumps status shall be hardwired to DM Plant Control System. 2) The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with. 3) All the instruments/drives shall be terminated on JB's/Panels in field. JB's/Panels shall be in Bidder's scope. 4) Primary sensor redundancy for Control/measurement shall be decided as per following general criteria: - Critical controls and respective measurements- Triple redundant. - Non-critical but important control & measurements- Dual redundant. - Only measurement- No redundancy. 5) Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification. Any cable in Bidder's scope shall be as per specification. 6) Redundant Power Supply feeders shall be provided by BHEL at a single point. Further distribution shall be in Bidder's scope.. The necessary hardware for the same shall be in Bidder's scope. Suitable Automatic changeover arrangement of the input feeders shall also be provided by the bidder in the LCP. Minimum 20% spare windows to be provided in each LCP. 7) Bidder to comply with codes and standards as mentioned in the specification. 8) All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. All transmitters shall be HART compatible. 9) Bidder to delegate /depute their persons/experts as per owner/consultants' requirement.		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
10) Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system. 11) The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL. 12) Any part/module of the C&I system which are not listed under recommended spares shall be deemed as having life expectancy not less than the expected life of the plant i.e. 30 years. 13) Instrument ranges shall be selected to have the normal reading ,preferably between 50% and 70% of full scale for linear parameters and 70% to 80% for flow measurements. Deviation indicators shall have the null position at mid scale. The normal operating parameter shall be identified with a clear green mark.		

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SECTION-D
(GENERAL TECHNICAL REQUIREMENT)

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SECTION-D1

(GENERAL TECHNICAL REQUIREMENT FOR MECHANICAL)

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
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1.0 DESIGN PHILOSOPHY:

The treatment shall be designed to minimize the formation of scale and build up of micro – organisms, and prevent fouling, and corrosion of the turbine condenser and other heat exchanger.

To inhibit scale formation in the CW system it is proposed to dose Sulphuric acid to convert calcium and magnesium bicarbonates into sulphates, which have higher solubility in water. synthetic polymer based Scale Inhibitor along with Corrosion inhibitor, Biocide and H₂SO₄ dosing Systems have been designed to dose required quantity of chemical to maintain CW quality at CW fore bay.

2.0 TANK AND PUMP CAPACITY SELECTION:

Acid Dosing (98% H₂SO₄) to maintain M-Alkalinity 250 ppm in circulating water.

Acid dosage rate	=	Make-up water X Dosage (ppm)/1000
	=	1537x(400-250/5)/1000 Kg/Hr.
	=	549.5 Kg/hr (Approx)
	=	560.7 kg/hr (98% H ₂ SO ₄)
Specific Gravity	=	1.84
Acid dosage rate	=	560.7/1.84 LPH.
	=	304.7 LPH.
Acid Dosing Pumps	=	600 LPH (selected).
Capacity of H ₂ SO ₄	=	304.7X24 = 7313.6 liters.
Day Tank	=	7500 Liters (selected)
Capacity of H ₂ SO ₄	=	
Bulk Storage tank	=	304.7 X 24X15 Liter.
	=	109705 Liter (2 numbers tank each of approx 55000 Ltrs).

Scale Inhibitor /corrosion inhibitor /biocide:

Scale inhibitor and corrosion inhibitor are a proprietary chemicals and level of its dosage in CW & ACW depends upon the the recommendations of chemical manufacturer and based upon plant operation. However, the Plant will be designed for 10-ppm dosage of either scale inhibitor or corrosion inhibitor, & for biocide dosing rate is maximum 3 ppm.

Scale inhibitor /corrosion inhibitor dosing rate	=	Make-up water (m ³ /hr) X dosage (ppm) /1000
	=	1537 X 10/1000
	=	15.37 kg/hr of 100% solution.
Specific gravity	=	1 (approx).
Chemical dosage rate	=	15.37/1 LPH (Approx).
	=	15.37 LPH.
Chemical Dosing Pump Considered	=	40 LPH (Selected).
Biocide dosing rate	=	Total CW+ACW flow (m ³ /hr) X dosage (ppm) /1000
	=	72324 X 3/1000
	=	216.972 kg/hr of 100% solution.
Specific gravity	=	1 (approx).
Chemical dosage rate	=	216.972 /1 LPH (Approx).
	=	216.972 LPH.
Chemical dosage rate	=	

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Considered. = 217 LPH (Approx).
Chemical Dosing Pump = 450 LPH (Selected).

Note: The dosing rate is envisaged for equipment sizing only.

3.0 CONTROL PHILOSOPHY & INSTRUMENTATION

The operation of the Circulating Water Treatment System (including Scale Inhibitor Injection System, Corrosion Inhibitor Injection System, Biocide Injection System & Sulphuric Acid Injection System) shall be from relay based Local Control panel located in CW Treatment plant building..

All the dosing/injection Pumps shall be operated from Relay based Local Control panel (LCP). Local operation (start/stop) is also provided through LPBS. Normally one (1) no. pump will be in service and one (1) no. will be as stand-by pump selection through LCP.

Sulphuric acid will be unloaded from road tankers by Sulphuric Acid Transfer Pumps into over ground Sulphuric Acid Storage Tanks.

The Sulphuric Acid Injection Pumps shall be operated from LCP. Local operation (start/stop) is also provided through LPBS. In the auto mode, the stroke shall be adjusted by sensing pH of Circulating Water. During normal operation, Sulphuric Acid Injection Pumps will operate in the auto-mode and inject sulphuric acid to maintain the pH of circulating water at a desired level to control scale deposition or corrosion. Adjustment of stroke shall be possible from remote as well as local manually.

Normally one (1) no. pump will be in service and one (1) no. will be as stand-by pump selection through OWS.

All effluents from Sulphuric Acid storage tank and Injection area will pass through a Lime/Neutralization Pit for neutralization before discharge into CW Forebay.

The operation of Scale Inhibitor Injection Pumps shall be automatic as well as local manual.

Normally one (1) no. pump will be in service and one (1) no. will be as stand-by pump selection through OWS.

The operation of Corrosion Inhibitor Injection Pumps shall be automatic as well as local manual.

Normally one (1) no. pump will be in service and one (1) no. will be as stand-by pump selection through OWS.

Monitoring equipment with reference to scale formation, corrosion and biological growth need to be provided to supervise the performance of the treatment systems.

ON/OFF/TRIP status of all pumps and drive motors as required shall be displayed in LCP. All pumps shall be tripped at Low Low level in respective tank. Acid unloading pumps shall be tripped at high level of bulk acid storage tank.

All drive motors shall be provided with arrangement of local starting and stopping (through LPBS). Local starting shall be possible through remote/local selector switch in MCC. Tripping of drive motors locally shall be permissible irrespective of position of remote/local selector switch. Provision for locking the local stop push buttons after tripping the motor from local push button shall be there. Annunciation showing tripping of different motors, level alarms from level switches/transmitters shall be located in the Operating Station.

Hard wired annunciation system shall also be provided for critical alarm in CW Pump House.

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SECTION-D2

(GENERAL TECHNICAL REQUIREMENT FOR ELECTRICAL)

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. I E C 33 999 999 2201
		VOLUME NO. : II-B
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1.0

INTENT OF SPECIFIATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer’s work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0

CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0

DESIGN REQUIREMENTS

3.1

Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2

Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3

Starting Requirements

3.3.1

Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2

Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.		
3.3.3 The following frequency of starts shall apply i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature. ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour) iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor		
3.4 Running Requirements		
3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.		
3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.		
3.5 Stress During bus Transfer		
3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.		
3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.		
3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.		
3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.		
4.0 CONSTRUCTIONAL FEATURES		
4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy		
4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.		
Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled		
4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.		

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4.4.	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.	
4.5	Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.	
4.6	In case Class ‘F’ insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class ‘B’ insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.	
4.7	Terminals and Terminal Boxes	
4.7.1	Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet “A”.	
4.7.2	unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.	
4.7.3	Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.	
4.7.4	Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.	
4.7.5	Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.	
4.7.6	Degree of protection for terminal boxes shall be IP 55 as per IS 4691.	
4.7.7	Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.	
4.7.8.	Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.	
4.7.9	Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.	
4.8	Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.	
4.9	General	

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4.9.1 Motors provided for similar drives shall be interchangeable. 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors. 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above. 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956. 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz. 4.9.6 Name plate with all particulars as per IS: 325 shall be provided 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions. 5.0 INSPECTION AND TESTING 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied. 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser. 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan. 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A. 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes. c) Characteristic curves: <i>(To be given for motor above 55 kW unless otherwise specified in Data Sheet).</i> i) Current vs. time at rated voltage and minimum starting voltage. ii) Speed vs. time at rated voltage and minimum starting voltage. iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling. iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.		

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1.0 SCOPE

- 1.1 This section covers the general requirements of the drive motors for power station auxiliary equipment.
- 1.2 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 1.3 In case of any discrepancy, the driven equipment specification shall govern etc.

2.0 STANDARDS

- 2.1 All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification.
- 2.2 Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed
 - (a) IS-325
 - (b) IS-12615
 - (c) IEC-34

3.0 SERVICE CONDITIONS

- 3.1 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash canopy to be provided to all outdoor install motors.
- 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.

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3.3 For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature

4.0 TYPE AND RATING

4.1 A.C. MOTORS

4.1.1 Motors shall be general purpose, constant speed, squirrel cage, three phase, induction type.

4.1.2 All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.

4.1.3 The motor name-plate rating at 50°C shall have at least 10% margin over the input power requirement of the driven HT equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.

4.1.4 The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.

4.1.5 All LT motors used in this project are proposed to be energy efficient type suitable for EFF1 efficiency rating.

4.1.6 The motor name plate rating shall have at least 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point.

4.1.7 Motors located in hazardous area shall be flame proof type.

4.2 D.C. MOTORS

4.2.1 D.C. Motor provided for emergency service shall be shunt/compound wound type.

4.2.2 Motor shall be sized for operation with fixed resistance starter for maximum reliability.

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4.2.3 Starter panel complete with all accessories shall be included in the scope of supply.

4.3 For equipment installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in determining the design ambient temperature.

5.0 PERFORMANCE

5.1 RUNNING REQUIREMENTS

5.1.1 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure.

5.1.2 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.

5.1.3 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

5.1.4 Motor shall not be stalled if the supply voltage drops to 70% of the rated voltage for 2 seconds duration.

5.2 STARTING REQUIREMENTS

Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries except boiler feed pump where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above for HT motors

5.2.1 The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage

5.2.2 Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal except BFP motor. In case of BFP motor, it shall

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be 75% rated voltage. Minimum starting requirement for mill motor (double cage) shall be 85% rated voltage at motor terminals.

- 5.2.3 Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition.

Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day.

Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction.

- 5.2.4 HT pump motors shall be suitable to start with forward rotation.

- 5.2.5 The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage

5.3 STRESS DURING BUS TRANSFER.

- 5.3.1 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.

- 5.3.2 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.

5.4 LOCKED ROTOR WITHSTAND TIME

- 5.4.1 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.

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5.4.2 Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.

5.4.3 Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilizing motor rated capacity

6.0 SPECIFIC REQUIREMENTS

6.1 ENCLOSURE

6.1.1 All indoor motor enclosures shall conform to the degree of protection IP-55 unless otherwise specified and outdoor motor enclosure shall confirm to degree of IPW-55. Motor for outdoor or semi-outdoor service shall be of weather-proof construction.

6.1.2 For hazardous area approved type of increased safety enclosure shall be furnished.

6.2 COOLING

6.2.1 The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air- cooled (CACA).

6.2.2 In case water cooling is required for very large motors, prior approval of the customer is to be obtained before proceeding ahead with design & manufacture.

6.3 WINDING AND INSULATION

6.3.1 All insulated winding shall be of copper.

6.3.2 All motors shall have class F insulation but limited to class B temperature rise.

6.3.3 Windings shall be impregnated to make them non-hygroscopic and oil resistant.

6.4 TROPICAL PROTECTION

6.4.1 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

6.4.2 All fittings and hardware shall be corrosion resistant.

6.5 BEARINGS

6.5.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.

6.5.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

6.5.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.

6.5.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.

6.5.5 Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.

6.5.6 Oiled bearing shall have an integral self cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.

6.5.7 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.

6.5.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.

6.5.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

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6.6 NOISE & VIBRATION

- 6.6.1 The noise level shall be as per statutory acceptance (IS/IEC).
- 6.6.2 The peak amplitude of the vibration shall be within IS/IEC specified limits.

6.7 MOTOR TERMINAL BOX

- 6.7.1 Motor terminal box shall be phase segregated (PSTB) type and located in accordance with Indian Standards clearing the motor base- plate/ foundation.
- 6.7.2 Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. For HT motors and 90 Deg. for LT motors unless otherwise approved.
- 6.7.3 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.
- 6.7.4 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.
- 6.7.5 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.
- 6.7.6 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- 6.7.7 The terminal box shall be capable of withstanding maximum system fault current for duration of 0.25 sec.
- 6.7.8 For 11kV and 3.3kV motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.
- 6.7.9 Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.
- 6.7.10 The gland plate for single core cable shall be non-magnetic type.

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- 6.7.11 Due to any reason, if the terminal box is found to be not suitable for the approved cable size for either HT/LT motors, then the bidder shall arrange necessary adopter box to facilitate the termination of cables. The adopter box shall be of the same short circuit rating and specifications as the main terminal box. The adopter box shall be located as near as possible to the main terminal box. The interconnecting cabling between adopter box and main terminal box along with providing suitable cable glands and termination kits as applicable shall also be done by the bidder.

6.8 GROUNDING

- 6.8.1 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GS bolts and washer

- 6.8.2 The grounding connection shall be suitable for accommodation of ground conductors as follows :

Motor above 90 kW : 75 x 10 mm GS Flat

Motor above 30 kW up to 90 kW : 50 x 6 mm GS Flat

Motor above 5 kW up to 30 kW : 25 x 6 mm GS Flat

Motor up to 5 kW : 8 SWG GS Wire

- 6.8.3 The cable terminal box shall have a separate grounding pad

6.9 RATING PLATE

In addition to the minimum information required by IS, the following information shall be shown on motor rating plate:

- (a) Temperature rise in Deg.C under rated condition and method of measurement.
- (b) Degree of protection.

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(c) Bearing identification no. and recommended lubricant.

(d) Location of insulated bearings.

6.10 CONSTRUCTION

6.10.1 Stator Core

The Stator Core Lamination shall be made of high-grade silicon/magnetic steel sheet varnished on both sides and pressed to form rigid core.

6.10.2 Rotor

The rotor construction shall be such that in case of dislodging of the rotor bar from the end ring, it should not come out and hit the stator core/stator winding and damage.

7.0 ACCESSORIES

7.1 GENERAL

Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application

7.2 SPACE HEATER

7.2.1 Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement.

7.2.2 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle.

7.3 TEMPERATURE DETECTORS

7.3.1 All 11kV and 3.3kV motors shall be provided with twelve (12) nos. Simplex type winding temperature detectors, four (4) nos. per phase.

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- 7.3.2 11kV and 3.3kV motor bearing shall be provided with duplex type temperature detectors.
- 7.3.3 The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.
- 7.3.4 Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.
- 7.3.5 Five numbers of Temperature detectors / thermisters shall be provided for L.T. Motors above 90 kW (3 nos. Winding temperatures & 2 nos. bearing temperatures).
- 7.4 INDICATOR/SWITCH
- 7.4.1 Dial type local indicator with alarm contacts shall be provided for the following :
- (a) 11kV and 3.3kV motor bearing temperature
 - (b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor
- 7.4.2 Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.
- 7.4.3 Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 5A at 240V A.C.
- 7.5 CURRENT TRANSFORMER FOR DIFFERENTIAL PROTECTION
- 7.5.1 Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 nos. CT for mounting on switchgear side shall be in bidder's scope.

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7.5.2 The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.

7.6 ACCESSORY TERMINAL BOX

7.6.1 All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.

7.6.2 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.

7.7 DRAIN PLUG

Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

7.8 LIFTING PROVISIONS

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

7.9 DOWEL PINS

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

7.10 PAINTING

Motor including fan shall be painted with corrosion proof paints of colour shade (RAL-7032).

8.0 TESTS

8.1 ROUTINE AND TYPE TEST:

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Tests are to be conducted for HT and LT motors 60kW and above in presence of Mahagenco representative and contractor as per IS: 325 and required copies of test certificates are to be furnished for approval and despatch clearance. In addition, following tests shall have to be carried out on the motors in presence of MAHAGENCO representative & contractor on LT & HT motors. For Motors below 60kW type and routine test conducted as per IS325 shall be witnessed by contractor and test certificate shall be submitted for review of Mahagenco & Dispatch clearance

8.1.1 FOR HT MOTORS:

- (a) Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-671/IS 14422,1995 test voltages as under

Voltage rating of motor	Impulse Test Voltage
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3.3 kV	: 18 kV peak
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11 kV	: 49 kV peak
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- (b) Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test
- (c) Polarization Index Test as per IS:7816 as routine test
- (d) Tan delta measurement on coils
- (e) Surge withstand test for inter turn insulation.
- (f) Test to diagnose rotor bar failure during manufacture.

Tests indicated at (d), (e), (f) shall be carried out during manufacture of the coils and shall be furnished for verification .

8.1.2 FOR HT & LT MOTORS:

- (a) Test for suitability of IP55/ IPW- 55 as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test,

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provided the test motor is identical to motor being supplied. Second numeral test shall be carried out on one motor of each type and rating.

- (b) Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box within last three years.
- (c) Test for noise level as routine test.
- (d) Test for vibration as routine test.
- (e) Overspeed test as type test.

8.2 TEST WITNESS:

Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

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AC & DC MOTOR

SR. NO.	ITEM	UNIT	
1.0	<u>AUXILIARY POWER SUPPLY</u>		
1.1	<u>H.T. SUPPLY</u>		
	11kV, 3Ø, 3W, 50 Hz non-effectively earthed		Motors rated 1000 kW and above
	Fault level 44 kA symm		
	3.3kV, 3Ø, 3W, 50 Hz, non-effectively earthed		Motors above 160 kW and below 1000kW
	Fault level 40 kA symm		
1.2	<u>L.T. SUPPLY</u>		
	415V, 3Ø, 3W, 50 Hz effectively earthed		Motors below and including 160kW
	Fault level 50 kA symm		
	240V, 1Ø, 2W, 50 Hz effectively earthed		Lighting, space heating, A.C. control & protective devices
1.3	<u>D.C. SUPPLY</u>		
	220V, 2W, unearthed		D.C. alarm, control & protective devices
	Fault level 25* kA.		
	Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation		
2.0	<u>RANGE OF VARIATION</u>		

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SR. NO.	ITEM	UNIT	
2.1	<u>A.C. SUPPLY:</u>		
	Voltage		± 10%
	Frequency		± 5%
	Combined Voltage & frequency		± 10% (absolute sum)
	During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance		
2.2	<u>D.C. SUPPLY</u>		
	Voltage		198 to 240 Volt