

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
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<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
		(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

CONSULTANT : PROCON ENGINEERS

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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) I I C, HYDERABAD
		(c) MINILEC, PUNE
		(d) IIC, MUMBAI
		(e) PIRIE, MUMBAI
		(f) PECON, VADODARA
		(g) POSITRONICS
2.13	RMCMs (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 / SO ₂ 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 SH/RH SPRAY BLOCK VALVES FEED CONTROL VALVES	(a)	MIL CONTROLS LTD.
		(b)	INSTRUMENTATION LTD. PALGHAT
		(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

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		(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 CORPN OF (I) LTD., CHENNAI
		(l)	RPG CABLES LTD., CHENNAI
		(m)	FORT GLOSTER INDUSTRIES LTD. KOLKATA
		(n)	DECO CABLES, DELHI
		(o)	KRISHNA CABLES, GWALIOR
8.3	COMPENSATING CABLES	(a)	DELTON CABLE

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		(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

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	WITH DCDB	(b)	AMARARAJA, TIRUPATI
		(c)	CHHABI ELECTRICALS, JALGAON
		(d)	HBL POWER SYSTEMS, HYDERABAD
		(e)	MASS TECH CONTROLS
9.3	BATTERY (TUBULAR/PLANTE) (TUBULAR) (TUBULAR)	(a)	EXIDE, KOLKATA
		(b)	HBL NIFE, HYDERABAD UNION BATTERY (BUI PUNE)
9.4	BATTERY (NICKEL- CADMIUM)	(a)	HBL POWER SYSTEMS, HYDERABAD
		(b)	AMCO, BANGALORE

Laboratory Instruments:

Bidder shall submit the vendor list with credentials for Mahagenco's approval.

NOTE : The vendors indicated in the above list are Mahgenco's approved vendors, however, the product of above vendors proposed for this project shall meet the requirements stipulated in 'Proven Product' Cl. No. 5.0 of Vol. V, Section I of Tender Specification.

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TITLE: **TECHNICAL SPECIFICATION
COLTCS
1 X 660 MW BHUSAWAL
SPECIFIC TECHNICAL REQUIREMENTS**

SPEC. NO.: **PE-TS-415-165-N002** , Rev 01
SECTION: **I**
SUB-SECTION: **ID**
REV. NO. **00** DATE **15.05.20** **9**
SHEET **1** OF **1**

**SUB-SECTION – ID
DATASHEET-A**



DATA SHEET - A			SPECIFICATION NO.: PE-TS- 415-165-N002 . Rev 01
CONDENSER ON LINE TUBE CLEANING SYSTEM (COLTCS)			REV. NO.: 00. DATE : 15.05.20
FOR CLARIFIED WATER APPLICATION			SECTION : I. SUB-SECTION : ID
SL NO	DESCRIPTION	UNITS	1X660 MW BHUSAWAL TPS
1.00	GENERAL		
1.1	Nos. of tube cleaning systems sets required for station	Nos.	Total Two (02) Nos. viz. One independent set for each half of the condenser
1.2	Liquid Handled		Clarified water (Refer enclosed water analysis at Annexure I)
1.3	Size of COLTCS	NB	2300
1.4	Length of Ball Separator	mm	4200 Note: 1. Scope of Ball Separator counter flange is in Purchaser's scope. (Associated Gaskets, nuts and bolts are in Bidder's Scope) 2. Ball Separator shall be mounted directly on the existing Butterfly valve - Refer Annexure III. 3. Flap of butterfly valve shall be extended to approx 1300-1400 mm inside the Ball separator.
2	DESIGN DATA		
2.1	Operating pressure at Condenser inlet flange	kg/cm2 (g)	Approx 1.5 to 2.5
2.2	Design Pressure for ball separator	kg/cm2 (g)	5.0 kg/cm ² (g)
2.3	Design Mechanical temperature	Deg. C	60
2.4	Condenser Details		
	a) Type of condenser		Single pass
	b) No. of Condenser sections	Nos.	Two (2)
	c) No. of passes per condenser section (viz. condenser half)	Nos.	One (1)
	d) No. of tubes per condenser	Nos.	35000
	• Condensing zone	Nos.	32520
	• Air Cooling zone	Nos.	2480
	e) Tube Dia. OD x Thickness		
	• Top two rows	mm x mm	22.225 x 1.244
	• Remaining	mm x mm	22.225 x 0.7112
	f) Length of tubes between ends.	mm	17900
	g) Tube material		Welded SS (ASTM A249, TP 316)
	h) Pressure drop across condenser - At Normal flow (between Inlet and Outlet flanges of condenser)	MWC	3.28 MWC (However the actual value can vary +/-10% of the design value)
2.5	CW flow rate through each ball separator		

	- Normal	cu.m/hr	34390
	- Maximum	cu.m/hr	41268
2.6	Design differential pressure for ball separator strainer/screen	kg/cm2 (g)	0.2
2.7	Pressure drop across ball separator i.e. between inlet & outlet flanges in clean condition at normal flow.	MWC	0.15
2.8	Pressure drop across ball separator in choked condition when strainer backwashing starts	MWC	Not to exceed 0.30
2.9	No. of balls required for COLTCS per condenser section		Minimum 10% of number of condenser tubes
3	CONNECTING PIPE DETAILS		
3.1	Condenser inlet pipe		
	a) Material		Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589
	b) O.D. X Thickness		2336 X 18
3.2	Condenser outlet pipe		
	a) Material		Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589
	b) O.D. X Thickness		2336 X 18
3.3	Manhole		Yes, 600 NB size
4	MATERIALS OF CONSTRUCTION		
4.1	BALL SEPARATOR		
	a) Body / housing		Carbon Steel to IS -2062 Gr.B. with epoxy painted inside (with minimum housing thickness same as connecting pipe thickness)
	b) Screen / Strainer		SS-316
	c) Strainer shaft		SS-316
	e) Internal Hardware in contact with circulating water including nuts, bolts , etc.		SS-316
	f) Site Glass provision		YES
4.2	BALL RECIRCULATING PUMP		Non clog Type
	a) Casing		CI
	b) Impeller		SA 351 CF8M
	c) Shaft		SS-316
4.3	BALL COLLECTOR		
	a) Body / housing		Stainless steel, SS 304
	b) Screen / Strainer/other internals		SS-316
	c) Site Glass Provision		YES
4.4	Differential pressure measuring system		SS-316
4.5	Injection nozzle		SS-316
4.6	Valves		

4.6.1	Check Valves (65 NB & Above)		For sizes 65 NB and above:- Swing check or dual plate type.
	a) Body & Bonnet		SS316, Flanged Ends
	b) Disc for Check Valve		SS316
	c) Stem		ASTM A182 Gr F6a
4.6.2	Check Valves (50 NB & Below)		For size 50 NB and below-Piston type
	a) Body & Bonnet		SS-316, Socket welded Ends
	b) Disc for Check Valve		SS316
	c) Stem		ASTM A182 Gr F6a
4.6.3	Gate/ Globe Valves 50 Nb & Below		
	Body & Bonnet		SS-316, Socket welded Ends
4.6.4	Gate/Globe Valves (65NB & above)		
	➤ Body & Bonnet		SA 351 CF8M
	➤ Disc		SA 351 CF8M
	➤ Stem		ASTM A182 Gr F6a
	➤ Companion Flange		SS316
4.6.5	BFV Valves (65NB & above)		BFV (400 Nb & above)
	➤ Body & Disc		-
	➤ Sealing, Retaining segment & internals		-
	➤ Bearing		-
	➤ Companion Flange		-
4.6.6	Ball valves		
	i) Body		SA 351 CF8M
	ii) Ball		SA 351 CF8M
	iii) Stem		SS316
4.7	Interconnecting Piping		By Bidder
	Material		SS316
5	COUNTER FLANGES FOR BALL SEPERATOR		
5.1	MATERIAL		
	a) Flanges		Carbon Steel to IS 2062 Gr. B or eq for thickness, drilling etc refer Annexure II in section 1 D, (In purchaser's scope)
	b) Fasteners		A 193 & A 194 (In Bidder's scope).
	c) Gaskets		Min 4 mm thick rubber (In Bidder's scope).
5.2	Drilling Standard		
6	OTHER COUNTER FLANGES		(for interconnecting piping, valves, bends, fittings, distributors, nozzles & support installation materials)
6.1	MATERIAL		

	a) Flanges		SS316 (In Bidder's scope)
	b) Fasteners		SS316 (In Bidder's scope)
	c) Gaskets		Min 4 mm thick rubber (In Bidder's scope).
7	Material of Other components not specified above		1. All Non-wetted Fastners in Bidder's Scope shall be of SS316 material. 2. Suitable for intended duty and shall be subject to Purchasers approval during detailed engg. In the event of order.
8	PAINTING		
8.1	External Surface		
	a) Surface preparation		SA - 2.5 of Swedish Specn. SIS-05-59-00-1967
	b) Primer		Two coat of Red Lead primer
	c) Intermediate		-
	d) Final paint		Two (2) coats of Synthetic enamel paint with minimum thickness of 35 microns dft of each coat.
8.2	Internal Surface		
	a) Surface preparation		SA - 2.5 of Swedish Specn. SIS-05-59-00-1967
	b) Primer		Two coat of Epoxy Resin based Red oxide primer
	c) Final paint		Adequate no. of coats (min. Two) of Synthetic Enamel paint to achieve total DFT of min. 200 microns. Colour- code shall be as per IS 9404
9	Adequate provision for future installation of cathodic protection		YES (Along with Sacrificial type anodic protection by purchaser)
10	Flow straightener for streamlining the CW flow in ball collecting strainer		If required as per bidder's design – the same to be incorporated by bidder in its constructional feature.
11	The tube cleaning system shall be designed for following operation modes		
	a) Automatic start up initiated by push button		YES
	b) Automatic shut down with ball collection effected by : i. Push button ii. Adjustable timer iii. Ball monitoring system		YES
	c) Automatic backwashing of ball separator with ball collection effected by : a. Push button b. Adjustable timer c. Diff. Pressure measuring system		YES
	d) Automatic emergency backwashing of ball separator effected by diff. Pressure measuring system		YES
	e) Automatic ball sorting initiated by push button		YES
	f) Provision for manual operation of complete tube cleaning system in case of control system failure		YES
	g) Whether the contacts for DPG, DPS and DPT are independent		YES

	h) Timer for Backwashing		YES
	i) Whether the ball monitoring system is designed to perform the following functions : i. Continuously counting the balls in circulation and giving an alarm calling for investigation of ball losses when the number of balls falls below a set value ii. Continuously measuring the size of the balls in circulation and initiating the shutdown of the tube cleaning system with alarm calling for replacement of balls when the no. of oversized balls falls below a set value		YES
	j) Whether the electronic processor of the ball monitoring system is provided with the following : i. Indicators for required basic ball charge ii. Indicators for recirculating ball quantity iii. Indicators for oversized ball quantity iv. Time counters for total cleaning system operating hours v. Time counters for cleaning system operating hours with sufficient no. of oversized balls vi. Recorders for ball consumption		YES
	k) Whether provision for self-testing and self-calibration are made		YES
12	MANDATORY SPARES - to be supplied under this specification –		YES (C&I Spares has been indicated in Annexure-A separately)
1	Sponge rubber balls for condenser on-load tube cleaning system	Nos.	50000
2	Ball circulating pumps (set consisting of shaft, rotor bearings, seals, gland package shafts sleeves for complete replacement in one pump)	set	1

Notes for Mandatory Spares:

1. In case if such items of spares indicated as “not applicable” by bidder in its offer, are found applicable at a later date during execution of the project, such items of spares are to be supplied within the ordered cost of the mandatory spares.
2. Wherever % is indicated for the mandatory spares, the quantity shall be calculated for % of supply for total quantity for 1 unit of 1 x 660 MW , unless otherwise specified. The quantity to be reckoned for % indicated shall be rounded off to the next higher whole number. For example if the % arrived is 0.2 the quantity to be supplied shall be 1 and if the % arrived is 5.1 the quantity to be supplied shall be 6.
3. In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I

ANNEXURE-A

C&I MANDATORY SPARES

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	measurement used.	
3.0	<u>MEASURING INSTRUMENTS</u>	
3.1	<u>ELECTRONIC TRANSMITTERS</u>	
3.1.1	Transmitters of all types, ranges and model no. (for the measurement of Pressure, differential pressure flow, level etc.)	10% or 2 no. of each type and model, whichever is more
3.1.2	Electronic cards / PCB's for each type and model and model of transmitters	10% or 5 nos. of each type, whichever is more
3.2	<u>TEMPERATURE ELEMENTS</u>	
3.2.1	RTDs of each type & length	10% or 2 nos. whichever is more
3.2.2	Thermocouples of each type like K-type, R-type, metal etc and length	10% or 2 nos. whichever is more
3.2.3	Thermowell for T/C & RTDs	10% or 1 no. of each type, rating, length used in the system whichever is more
3.2.4	Process actuated switch devices Including all types of pressure, differential pressure, flow, temperature, differential temperature, level switch devices	10% or 1 no. of each type and model whichever is more
3.3	<u>INDICATORS/RECORDERS</u>	
3.3.1	Digital Indicators of each model, type & range (including relevant digital indicators of electrical system)	10% or 2 nos. min. whichever is more

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3.3.2	Vertical Indicators of each type & model	5% or 1 no. of each model whichever is more
3.3.3	Recorders for each type and model	5% or 1 no. whichever is more.
3.3.4	Consumables for continuous recorders Charts Ink capsules	25 rolls per recorder/ 25 nos per recorder/ 20 nos. per recorder / Ink Pads /Pens.
3.3.5	Consumables for multi point recorders	
(a)	Charts	5 nos. per recorder
(b)	Ink pads	5 nos. per recorder
(c)	Print mechanism/ print head assembly	10% or 5 nos. of each type whichever is more
3.3.6	Level transmitters (displacer type)	
(a)	Electronic cards / PCB's of level transmitters	10% of total quantity used or 1 for each type/rating whichever is more
(b)	Level transmitters	10% of total quantity used or 1 for each type/rating whichever is more
(c)	Electronic water level indicator	10% or 2 nos. min. whichever is more
3.3.7	PD type flow transmitters	10% of total quantity used or 1 for each type/rating whichever is more
3.4	<u>SWITCHES</u>	
3.4.1	Switches (Pressure, DP, Level, Flow, Temperature etc)	10% of each type of total nos. used in the system or minimum 1 no. of each type, model & range whichever is more

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3.5	Rotameter	10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more	
3.6	<u>SOLENOID VALVE</u>	10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more	
3.6.1	Assembly	10% of total quantity used or minimum 2 no. of each type whichever is more	
3.6.2	Coil	10% of total quantity used or 5 no. whichever is more	
3.7	E/P Converter	10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more	
3.8	<u>SPECIAL INSTRUMENTS</u>		
3.8.1	Nucleonic /non-nucleonic density meter, solid flow meter etc.	1 no. and spare parts as per manufacturer	
3.9	Electrical Transducers	10% of total quantity used or minimum 1 no. of each type and range whichever is more	
4.0	<u>POWER SUPPLY SYSTEM</u> <u>(24 V DC POWER SUPPLY SYSTEM)</u>		
4.1	Silicon controlled thyristors, diodes power transistors	100%	

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4.17	Rubber gloves	1 no.	
4.18	Voltmeter for measuring cell voltage (centre zero type)	1 no.	
4.19	Thermometer	1 no.	
4.20	Insulated socket spanner with handle	1 no.	
5.0	<u>PROCESS CONNECTION PIPING</u> (for impulse piping /tubing, sampling piping/ tubing and air supply piping as applicable)		
5.1	Valves of all types and models	10% or 2 no. of each type, class, size and model whichever is more.	
5.2	2 way, 3way, 5way valve manifolds	10% or 2 no. of each type, class size and model whichever is more.	
5.3	Fittings	10 nos. of each type	
5.4	Purge meters	10 % of each model or 2 Nos. whichever is more	
5.5	Filter regulators	10% of each model or 2 Nos. whichever is more	
5.6	Impulse pipe & tubing of all type	20 mtrs each type & size	
5.7	Impulse line root valve	10% of total quantity used or 4 no. whichever is more for each type and rating of each size	
5.8	SS tube	40 mtrs of each type/size	
5.9	Fitting for SS tube	40 nos. of each type/size	

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6.0	<u>INSTRUMENTATION CABLE, INTERNAL WIRING AND ELECTRICAL FIELD</u>	
6.1	Pre fabricated cable of each type	10% of installed quantity
6.2	Pre fabricated cable connector	10% or 1 no. of each type and model, whichever is more.
6.3	Other cables	10% of each type, pair and size of actual installed quantity
7.0	<u>ELECTRICAL ACTUATORS</u>	
7.1	Actuators	10% or 1 no. of each type, model and rating, whichever is more.
7.2	Power unit for modulating actuator	10% or 2 nos. of each type, whichever is more.
7.3	DC-DC unit/power pack units	10% or 2 nos. of each type, whichever is more.
7.4	Electronic cards	10% or 5 nos. of each type, whichever is more
7.5	Brake assembly	10% or 2 nos. of each type, whichever is more..
7.6	Brake coils	10% or 2 nos. of each type whichever is more.
7.7	Position feed back transmitters	10% or 2 nos. of each type whichever is more.
7.8	Control unit	10% or 2 nos. of each type whichever is more
7.9	Torque and limit switch assembly of each unit	10% or 2 nos. of each type, whichever is more.
7.10	O-ring	1 set of each size

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7.11	Motor	1 no. of each type & rating	
7.12	Auxiliary contact	10% of total quantity used or 2 nos. whichever is more for each type and rating of each size	
7.13	Seal kit	1 set of each type & size	

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8.24	Micro PLC system (i.e. integrated CPU & I/O system, where above mentioned components are not applicable)	One Complete Set

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<u>SR. NO.</u>	<u>EQUIPMENT/PACKAGE NAME</u>	<u>QUANTITY</u>
17.0	<u>CONTROL PANEL AND LOCAL/REMOTE CONTROL DESK (AS APPLICABLE)</u>	
17.1	Recorder	1(one) No. each type and model
17.2	Bar graph indicator	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
17.3	Digital indicator	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
17.4	Mosaic/Conventional Type Push button Station	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
17.5	Mosaic Type Push button Station with LED Indication	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
17.6	Mosaic Type LED Indication Station	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
17.7	Simaphore Indicator	2(two)Nos. each type
17.8	<u>ANNUNCIATION SYSTEM</u> (For offsite / Auxiliary Plants)	
17.8.1	Each type of PCB (for non-PLC driven system)	1(one) No. each

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.		MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
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<u>SR. NO.</u>	<u>EQUIPMENT/PACKAGE NAME</u>	<u>QUANTITY</u>	
17.8.2	Lamp Box with Facia & Lamps (LED type)	10% with minimum 2 nos.	
17.8.3	Hooter	1(one) No.	
</			

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
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30.0	<u>MANDATORY SPARES NOT COVERED ABOVE</u>	Bidder to supply 10% electronic modules/ cards or any other electronic components required for system such as annunciation system for offsite/auxiliary plant, online condensate tube cleaning system, ambient air monitoring system, plant simulator.

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 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
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ANNEXURE – B

CLARIFIED WATER & FILTERED WATER ANALYSIS

1.0 WATER QUALITY AT CLARIFIER OUTLET

- (a) Residual Chlorine : 0.1 ppm as Cl₂
- (b) Iron Content : < 0.1 ppm as Fe
- (c) Turbidity : < 15 NTU

2.0 WATER QUALITY AT GRAVITY FILTER OUTLET

- (a) Turbidity : < 2 NTU
- (b) Organic Content : Nil

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-E1
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section-2
REV: R0	WATER TREATMENT SYSTEMS		Page 41 of 313
<u>ANNEXURE-I</u> <u>ANALYSIS OF RAW WATER</u>			
<u>SR. NO.</u>	<u>PARAMETERS</u>	<u>UNITS</u>	<u>VALUES</u>
1.0	pH		8.0 – 8.5
2.0	Temperature	°C	22 - 30
3.0	Conductivity	µS/cm	1300
4.0	Colour	Hazen Units	Not Available
5.0	Odour		Not Available
6.0	Taste		Not Available
7.0	TDS	ppm	870
8.0	P-Alkalinity as CaCO ₃	ppm	Nil
9.0	M-Alkalinity as CaCO ₃	ppm	400
10.0	T – Alkalinity as CaCO ₃	ppm	400
11.0	Organic Matter as KMnO ₄	ppm	50
12.0	Iron (as Fe)	ppm	1
13.0	Turbidity (NTU)	ppm	100 during Non – Monsoon Up to 10,000 during Monsoon
14.0	CATIONS		
	(a) Ca as CaCO ₃	ppm	295
	(b) Mg as CaCO ₃	ppm	77
	(c) Na as CaCO ₃	ppm	203

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<u>SR. NO.</u>	<u>PARAMETERS</u>	<u>UNITS</u>	<u>VALUES</u>
	(d) K as CaCO ₃	ppm	10
	Total Cation	ppm	585
15.0	ANIONS		
	(a) HCO ₃ as CaCO ₃	ppm	400
	(b) Chlorides	ppm	149
	(c) SO ₄ as CaCO ₃	ppm	33
	(d) Fluoride as CaCO ₃	ppm	1
	(e) Nitrate as NO ₃	ppm	2
	Total Anion	ppm	585
16.0	Ammonia	ppm	Absent - Traces
17.0	Silica Colloidal (as SiO ₂)	ppm	< 1 (can be present in summer)
18.0	Silica Non - Colloidal (as SiO ₂)	ppm	36
19.0	Free Chlorine	ppm	Nil
20.0	Total Suspended Solids	ppm	Not Available
21.0	Carbonates as CaCO ₃	ppm	Not Available
22.0	Boron	ppm	Not Available
23.0	Oil & Grease	ppm	Not Available

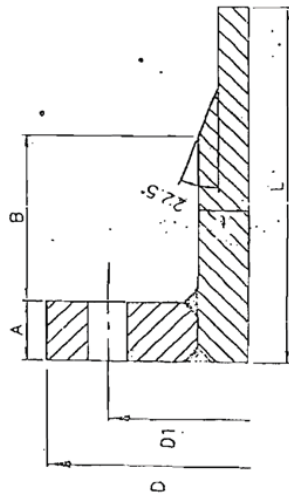
CONSULTANT : PROCON ENGINEERS

ANNEXURE-II

ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

7104-141-666-00-3d 3d DWG



NOTES:-

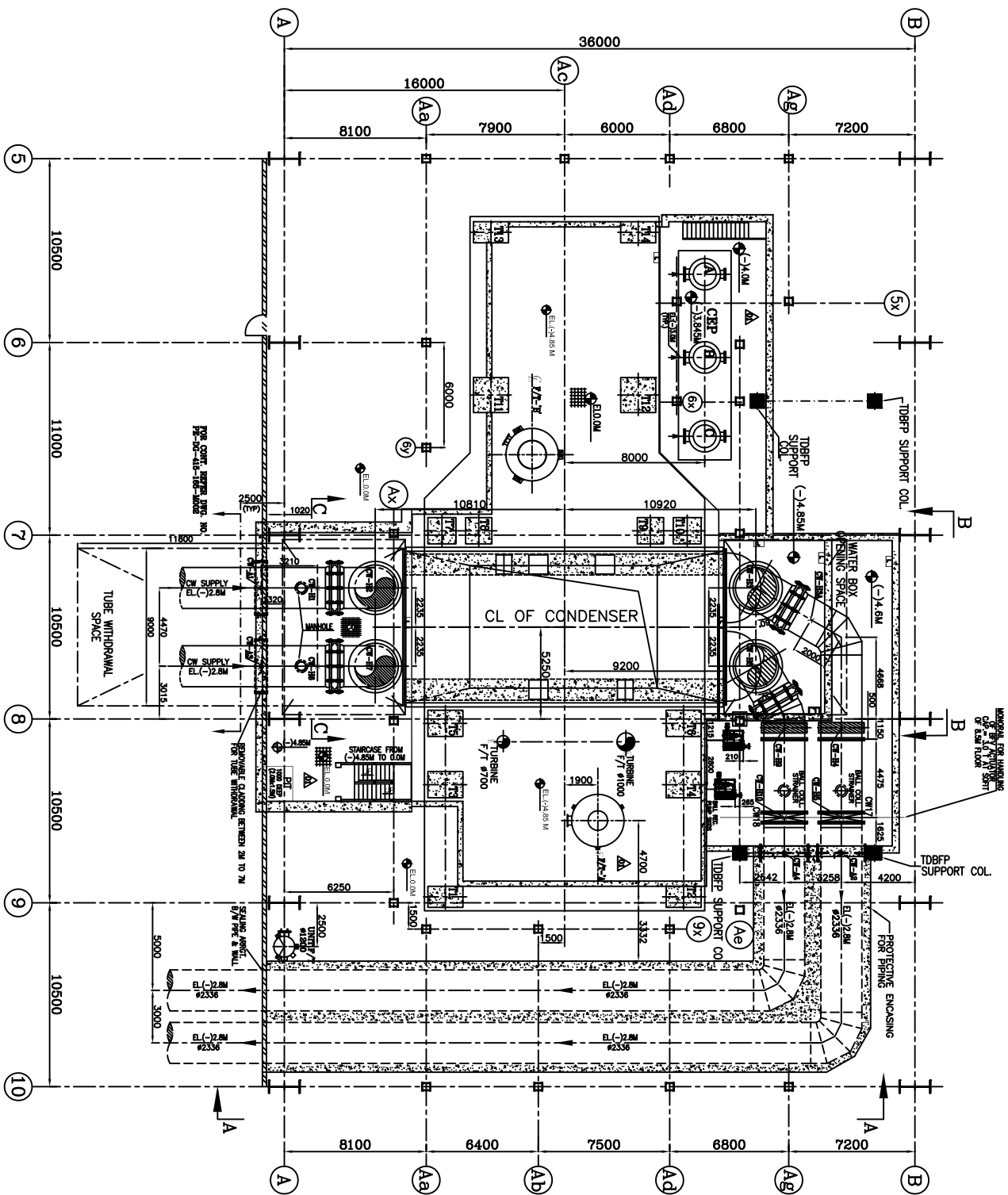
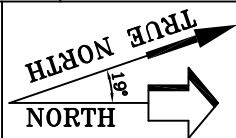
Flange thicknesses listed are for Design pressure=5Kg/cm²(g) and Flange dimensions as given in the table. Final thickness of the flange is to be checked for actual OD/Bolting PCD/Neck dimensions.

PIPE SIZE	PIPE THK.	FLANGE OD 'D'	BOL PCD 'D1'	WELD NECK FLANGE		SLIP-ON FLANGE THICKNESS		
				FLANGE THICK. 'A'	NECK THICK. 'B'			
1200	10-12	1465	1380	40	24	70	200	90
1400	14	1675	1590	50	24	70	200	100
1600	14	1915	1920	60	32	80	220	110
1800	14-16	2115	2020	70	32	90	250	120
2200	18	2550	2420	80	36	100	300	140
2300	18			90	38	110	325	150
2500	20			90	38	110	325	150
2700	20			90	38	110	325	150

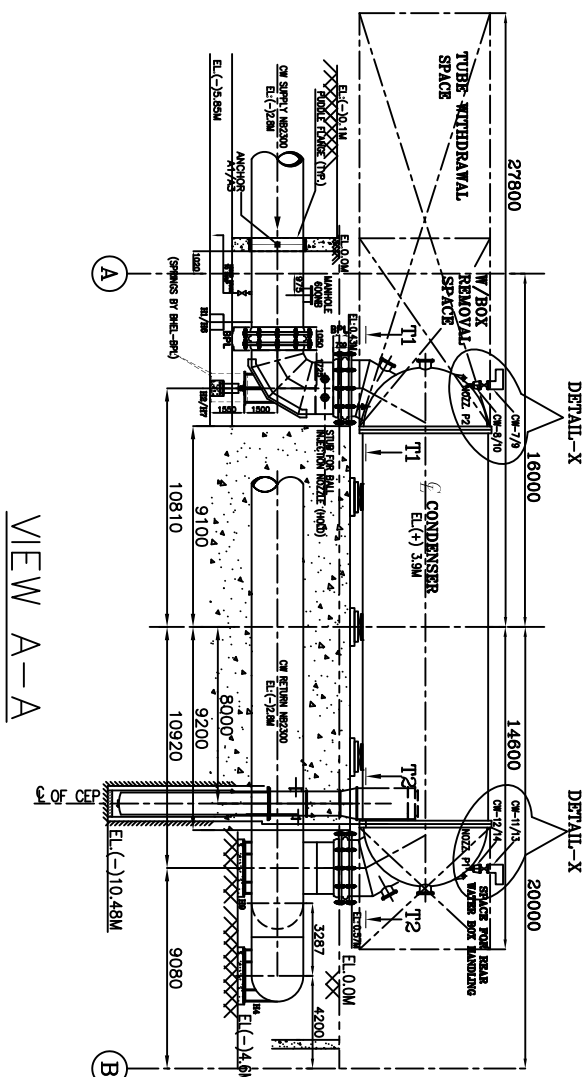
— TENTATIVE

DRAWING FOR BAL SEPARATOR COUNTER FLANGE

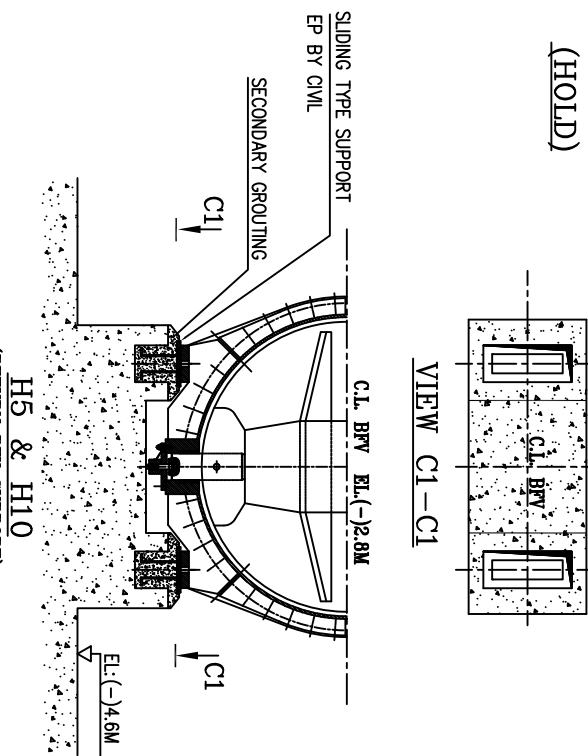
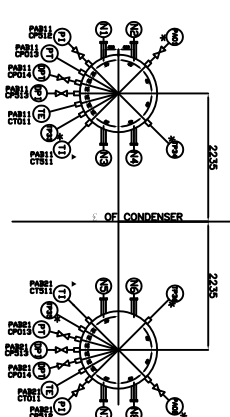
REV.	DATE	ALT.	QTY	APPR.	JOB NO.	999
STATUS					DISTRIBUTION	
BIHARAT HEAVY ELECTRICALS LTD. PROJECTS ENGINEERING MANAGEMENT PPEL, NOIDA						
TITLE					COUNTER FLANGE DETAILS	
DRAWING NO.					PC-999-141-M017	
SHEET 01 OF 01					REV 00	



PLAN VIEW

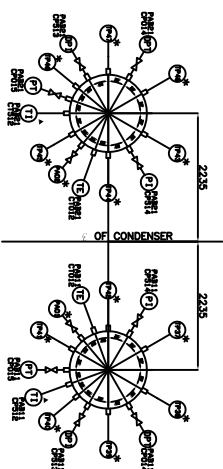


VIEW A-A

H5 & H10

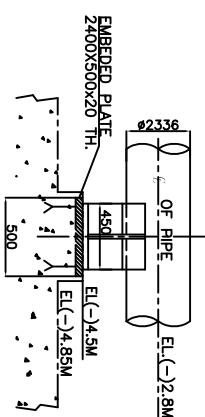
VIEW T1-T1

DETAILS OF BALL INJECTION NOZZLES & INST. STUBBS ON INLET LINE OF CONDENSER

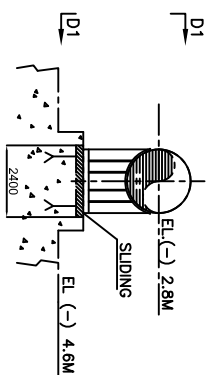


VIEW T2-T2

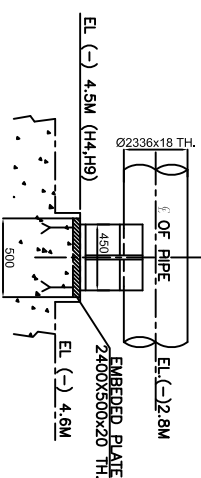
DETAILS OF BALL INJECTION NOZZLES & INST. STUBS ON OUTLET LINE OF CONDENSER



SUPPORTS H1 & H6



SUPPORTS-H4,H9



VIEW D1-D1



TITLE:
**TECHNICAL SPECIFICATION
COLTCS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-165-N002**, Rev 01
SECTION: **II**
SUB-SECTION: **IIA**
REV. NO. **0** DATE (15.05.20
SHEET **1** OF **1**

SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

STANDARD TECHNICAL SPECIFICATION FOR COLTCS

STANDARD QUALITY PLANS



TITLE :

SPECIFICATION NO. PE-TS-999-165-N002

STANDARD TECHNICAL SPECIFICATION
CONDENSER ON - LOAD TUBE CLEANING
SYSTEM (Sponge Rubber Ball Type)

SECTION : II

SUB-SECTION : IIA

REV. NO. 01

DATE : 26.05.2016

SHEET 1 OF 11

1.00.00 GENERAL

This specification covers the design, performance and operational requirements, configuration and constructional features, manufacture, assembly, inspection and testing at the manufacturer's and/or his sub-contractor's works and painting for delivery of condenser on-load tube cleaning system (sponge rubber balls type) complete with all accessories as specified hereinafter. Each half of the condenser shall be provided with an independent tube cleaning system.

2.00.00 CODES AND STANDARDS

2.01.00 The design, materials, manufacture, inspection and testing of the condenser on-load tube cleaning system complete with all accessories, shall comply with the requirements of the latest versions of the following appropriate codes and standards.

2.01.01 IS/BS/DIN/US Standards regarding pressure vessels, pumps, piping, flanges and others as necessary.

2.01.02 IS/BS/DIN/ASTM Standards for materials specification and testing procedures.

2.01.03 IS/BS/DIN/AWWA Standards for valves and the testing.

2.02.00 In case of any conflict between the above codes/standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

3.00.00 DESIGN AND CONSTRUCTION

3.01.00 General Requirements

3.01.01 Unless otherwise necessary, manufacturer's standard and proven models of the tube cleaning system shall be supplied.

3.01.02 The tube cleaning system shall be capable of safe, continuous and trouble-free operation for removal of fouling and scaling materials from condenser tubes. Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes/standards. In design, due attention shall be given to ease of maintenance, repair and cleaning.

3.01.03 Suitable Corrosion allowance shall be provided whenever necessary. Adequate provision for future installation of cathodic protection shall be provided.

3.01.04 The tube cleaning system shall consist of ball separator at condenser outlet, recirculating pump, ball collector, differential pressure measuring system for ball separator, ball monitoring system, cleaning balls, piping valves, distributors, injection nozzles, instrumentations, control panel, interconnecting cables and others as necessary. The configuration of the tube cleaning system shall be as described in section C and / or as per the scheme enclosed.



TITLE :

SPECIFICATION NO. PE-TS-999-165-N002

STANDARD TECHNICAL SPECIFICATION
CONDENSER ON - LOAD TUBE CLEANING
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SUB-SECTION : IIA

REV. NO. 01

DATE : 26.05.2016

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3.02.00 DELETED

3.03.00 **Operational Requirements.**

The tube cleaning system and other accessories shall be designed for the following operation modes :

3.03.01 Complete automatic start-up of tube cleaning system initiated by pressing the push button (manual command).

3.03.02 Complete automatic shut-down of tube cleaning system with ball collection, effected by the following :

- ◆ Push button (manual command).
- ◆ Adjustable timer (after a defined cleaning period).
- ◆ Ball monitoring system (when the number of oversized balls falls below a set value).

3.03.02 Complete automatic backwashing of ball separator with ball collection, effected by the following :

- ◆ Differential pressure measuring system at a pre-determined differential across the ball separating strainer/ screen.
- ◆ Adjustable timer
- ◆ Push button

3.03.04 Complete automatic emergency backwashing of ball separator with alarm, indication, effected by differential pressure measuring system.

3.03.05 Manual operation for start-up, shut-down with ball collection backwashing of ball separator, flushing of differential pressure measuring system etc., in case of failure of control system.

3..04.00 **Ball Separator**

3.04.01 Ball separator body shall be of rigid construction and shall be designed and manufactured as per the applicable codes for pressure vessels. It shall house the ball separating screen / strainer and shall have flanged inlet, outlet, ball extraction opening and pressure measuring tappings etc. Body shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of forces and moments as enclosed in the specification. However in no case thickness of housing/body shall be less than the connecting pipe thickness as specified in data sheet A

3.04.02 The ball separator shall be provided with manhole with bolted cover and sight glass to observe its internals.

3.04.03 If specified in Data Sheet -A, ball separator body shall be Epoxy lined.



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- 3.04.04 The ball separating screen / strainer shall be designed for the maximum differential pressure across the separator and shall be securely mounted in the body. Screen / strainer shaft shall be sized adequately considering the overloading of screens / strainer due to debris accumulation.
- 3.04.05 The ball separating strainers / screens shall have electric actuators for swivelling to allow for their backwashing. Also suitable hand wheels shall be provided to enable manual swivelling of strainers / screens.
- 3.05.00 **Ball Recirculating Pump**
- 3.05.01 The ball recirculating pump shall be horizontal centrifugal type. The casing shall be designed to withstand 1.5 times the shut-off pressure or twice the operating pressure, whichever is higher.
- 3.05.02 The impeller shall be non-clog type and shall be contoured suitably to avoid damage to the cleaning balls. The impeller shall be secured suitably to the shaft and shall be retained against circumferential movement by keys, pins or lock rings. Loctite compound shall be applied after tightening of locknuts to prevent dislocation of impeller.
- 3.05.03 Replaceable type wearing ring shall be provided to prevent damage to the casing and impeller.
- 3.05.04 Pumps shall be provided with mechanical seals to the extent feasible. If Gland packing is provided it should be of good quality to be provided to prevent leakage of water from pump glands.
- 3.05.05 Shaft size selected shall take into Consideration the critical speed which shall be away from the operating speed as recommended in applicable codes / standards. Renewable type fine finished shaft sleeves shall be integral with water thrower plates at the end and the length must extend beyond the outer faces of gland packing so as to distinguish between the leakage between shaft and the shaft sleeve and that past the seals / glands.
- 3.05.06 Bearings of adequate design shall be provided for taking the entire pump load arising from all probable conditions of continuous operation through its range of operation. The bearings shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point. Proper lubricating element does not contaminate the liquid being pumped. Bearings shall be easily accessible without disturbing the pump assembly
- 3.05.07 Stuffing box of suitable design to permit replacement of packing without removing any part other than the gland shall be provided. The stuffing boxes shall be sealed / cooled by the fluid being pumped.
- 3.05.08 Pumps shall be of self-lubricated, self - sealed and self-cooled type. All pipework, fitters etc., for sealing, cooling and lubricating purpose shall be supplied and no external cooling/lubricating/sealing water will be supplied. Pump capacity shall take into account



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the cooling/lubricating/sealing water requirement.

- 3.05.09 All rotating components shall be statically and dynamically balanced.
- 3.05.10 The pump shall be designed such that pump impellers and other accessories of the pump, are not damaged due to flow reversal.
- 3.05.11 The pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the head Vs. flow characteristic curve over a range or 40% of rated flow to 120 -130 % of rated flow.
- 3.05.12 The pump shall preferably be non-overloading type. The total head Vs. capacity curve shall be continuously rising from the maximum flow point towards shut-off without any zone of instability.
- 3.05.13 The pump shall run smoothly without undue noise and vibration. Peak to peak vibration limits and noise level shall be within the acceptable values of applicable codes/standards.
- 3.05.14 The pump and motor shafts shall be connected through a pin and rubber bush flexible type of couplings. Suitable coupling guards shall be provided for the couplings.
- 3.05.15 The pump shall be capable of being started with discharge valve fully opened. Motor rating shall be adequate for this condition. The output KW rating of the pump drive motor shall not be less than the larger of the following :
- a) Maximum power input to the pump over the entire range for maximum flow to shut-off condition.
 - b) 125% of power input to the pump at duty point corresponding to 103% of the rated speed.
- 3.06.00 **Ball Collector**
- 3.06.01 The body of the ball collector shall be designed to withstand 2.0 times the operating pressure or 1.5 times the recirculating pump shut-off pressure, whichever is higher. The ball collector shall be designed and manufactured as per the applicable codes for pressure vessels.
- 3.06.02 Ball collector shall be provided with an inspection window/sight glass for visual inspection of the cleaning balls.
- 3.06.03 Ball collector shall be provided with suitable ports with covers for ball feeding and removal.
- 3.06.04 The ball collector shall be provided with vent and drain connections with isolating valves.
- 3.06.05 Provision shall be made in the ball collector for separating the undersized balls and ball collector shall have a separate chamber for collecting the undersized balls.



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DATE : 26.05.2016

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3.06.06 If specified in Data Sheet -A, ball collector body shall be lined with suitable resilient material.

3.06.07 The differential pressure measuring system shall be provided with D.P. transmitter ,DPS & DPGof remote seal arrangement.

3.07.00 **Differential Pressure Measuring System.**

3.07.01 The ball separator shall be provided with a measuring system for differential pressure across the ball separating strainer/screen, to check debris accumulation and to initiate ball catching and backwashing operations. This shall consist of a differential pressure switch/transmitter for automatic backwashing operation, a differential pressure guage for manual observation with adequate number of tappings with isolating valves.

3.07.02 The contacts for differential pressure switch/transmitter and for differential pressure guage shall be independent so that in the event of failure of one, the other is available.

3.07.03 The differential pressure measuring system shall be with remote seal arrangement .

3.08.00 **Ball Monitoring System**

3.08.01 Ball monitoring system shall be provided for continuously monitoring the quantity and size of the cleaning balls in circulation. The monitoring system shall perform the following functions :

- a) Continuously counting the oversize balls in circulation and giving an alarm calling for investigation of ball losses, when the number of oversize circulating balls falls below a set valve.
- b) Continuously measuring the size of the balls in circulation and initiating the shut-down of the tube cleaning system with alarm calling-for replacement of balls when the number of oversized balls falls below a set valve.
- c) Bidder's if not manufacturing ball oversized monitor, can supply automatic ball sorter in lieu of same for automatic sorting of the undersized balls.

3.08.02 The monitoring system shall be of proven and reliable design and shall be complete with necessary transducers, amplifiers, transmission lines, power cables and electronic processor etc.

3.08.03 The electronic processor of the ball monitoring system shall be housed in the control panel and shall consist the following : -

- a) Indicators for
 - ◆ required basic ball charge.
 - ◆ recirculating ball quantity.
 - ◆ oversized ball quantity.



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- b) Time counters for
- ◆ total cleaning system operating hours.
 - ◆ cleaning system operating hours with sufficient number of oversized balls.
- c) Recorder for ball consumption.

3.08.04 The ball monitoring system shall have provisions for self-testing and self-calibration.

3.09.00 **Cleaning Balls**

3.09.01 The sponge rubber cleaning balls shall be slightly oversized to the internal diameter of condenser tubes and should be able to remove all fouling and scaling deposits in the condenser tubes.

3.09.02 The specific gravity of the cleaning balls shall be such that good distribution of balls across the tube sheet and cleaning of all tubes are ensured.

3.09.03 The composition of the cleaning balls shall be based on natural rubber and shall be suitable for temperature upto 100°C. Hardness of the cleaning balls shall be compatible to tube material and corrosion/fouling behaviour. If cleaning balls consist of abrasive coated balls, the abrasive material shall also be compatible for use with the tube material.

3.09.04 Calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc., shall be furnished during contract stage.

3.10.00 **Piping, Valves, Distributors and Injection Nozzles.**

3.10.01 Interconnecting piping, valves, injection nozzles and other fittings shall be designed to withstand 2.0 times the operating pressure or 1.5 times the pump shut-off pressure whichever is higher.

3.10.02 Interconnecting piping shall be sized and routed optimally. Velocity in the pipe work shall be less than 1.5 m/s for pump suction and less than 2.2 m/s in other pipe work.

3.10.03 Necessary isolation valves, vent and drain valves for various equipments shall be provided. Valves shall conform to appropriate standards. Valves provided in ball transport piping shall be ball type. Gland packing of all valve shall be of superior quality to avoid leakage. All valves upto 150 Nb shall be ball valves. For higher sizes, gate / globe / B.F. valves shall be provided. All instrument valves shall be needle valves.

3.10.04 Adequate number of ball injection nozzles shall be provided for proper distribution of cleaning balls in condenser inlet. Ball injection nozzles shall be flanged type and shall have two sets of flanges, one for connecting to ball transport pipe and other for connecting to the stub on condenser inlet pipe for ease of removal during repairs or checking.

3.10.05 Distributors (if applicable) with sight glass shall be provided wherever ball transport



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pipings branching out or joining together for proper guidance of cleaning balls.

3.10.6 Type of valves shall be ball valves, no diaphragm type valve shall be used.

3.11.00 **Actuators**

3.11.00 Tube cleaning system shall be provided with actuators wherever necessary for various automatic operations. The actuators shall be electric motor operated and shall meet the requirements of the enclosed specification. The actuator shall be provided with auxiliary handwheel for manual operation in the event of control system failure.

3.12.00 **Electric Motors**

The drive motors for recirculating pump and differential pressure measuring system flushing pump shall conform to the requirements of the enclosed specification.

3.13.00 **Instrumentation and Control System.**

3.13.01 Complete instrumentation and control system for automatic operation of tube cleaning system, protection, interlocking, indication / annunciation of differential pressure and other malfunctions etc., shall be provided. This shall consist of adequate operational hardware, local control panel (As applicable) and interconnecting control and power cabling between the control panel and various equipments in the tube cleaning system.

3.13.02 The control panel shall house all necessary instruments, indicating / annunciation lamps, alarms, differential pressure indicator, timer, function selection switches, ball monitoring system processor, relays, protection and interlocking systems, start / stop push button etc., and shall be complete with internal wiring. The control panel shall meet the requirements of the enclosed specification.

3.13.03 Pressure gauges shall be provided at recirculating pump suction and discharge. All instrumentation shall be of reputed make and shall meet the requirements of the enclosed specifications.

3.14.00 **Other Accessories.**

3.14.01 Counter flanges, complete with gaskets, bolts and nuts etc., shall be supplied for ball separator inlet, outlet connections and all other terminal points. Fabrication, dimensions and drilling of the flanges shall conform to the codes/standards specified in Data Sheet-A / Section -C.

3.14.02 Ball recirculating pump, ball collector with interconnecting piping and valves, shall be mounted on a frame. For fixing the frame, necessary foundation plates, bolts, nuts etc. shall be provided.

3.14.03 Suitable lifting arrangement shall be provided for various equipments of the tube cleaning system, for handling during erection and maintenance.

	TITLE : STANDARD TECHNICAL SPECIFICATION CONDENSER ON - LOAD TUBE CLEANING SYSTEM (Sponge Rubber Ball Type)	SPECIFICATION NO. PE-TS-999-165-N002	
		SECTION : II	
		SUB-SECTION : IIA	
		REV. NO. 01	DATE : 26.05.2016
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4.00.00	DELETED
5.00.00	<u>SHOP INSPECTION AND TESTS</u>
5.01.01	<u>General</u>
5.01.01	Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the various equipments and other accessories of the tube cleaning system shall conform to the requirements of this specification and of the applicable codes / standards.
5.01.02	All materials used for manufacture /fabrication of the various equipments of the tube cleaning system shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests as per the approved quality plan and applicable codes at his cost for which samples shall be identified by BHEL's representative.
5.01.03	All shop tests shall be conducted as per approved quality plan and test certificates / reports for the same shall be furnished to BHEL for approval.
5.01.04	Qualification of welding procedures and welders shall be as per ASME B&PV code, Section - IX / applicable codes.
5.2.00	<u>Ball Separator</u>
5.02.01	Chemical analysis, mechanical tests shall be carried out on materials used for body, strainer / screen, strainer / screen shaft and other appurtenances as per the applicable material specification standards.
5.02.02	All butt welded joints shall be subjected to radiographic/ ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.
5.02.03	Strainer / screen shaft shall be subjected to ultrasonic test as per ASTM-A388 for subsurface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.
5.03.00	<u>Ball Recirculating Pump</u>
5.03.01	Chemical analysis, mechanical tests shall be carried out on materials used for casing, impeller, shaft, sleeves, wear rings etc., as per the applicable material specification standards.
5.03.02	The casting used for pump casing and impeller shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts, distortion and other harmful defects. All accessible surfaces of the impeller shall be subjected to penetrant test as per ASTM-

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5.03.03	E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1. No welding or repairs shall be carried out without prior permission of BHEL. Pump shaft and sleeves shall be subjected to ultrasonic test as per ASTM - A388 for sub-surface defects and penetrant test after finish machining as per ASTM-E165 for surface defects.		
5.03.04	Wear rings shall be subjected to penetrant test as per ASTM-E165.		
5.03.05	Pump impellers and rotor assembly shall be statically and dynamically balanced as per ISO-1940		
5.04.00	<u>Ball Collector</u>		
5.04.01	Chemical analysis, mechanical tests shall be carried out on materials used for body and other appurtenances / accessories as per the applicable material specification standards.		
5.04.02	All but welded joints shall be subjected to radiographic / ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.		
5.05.00	<u>Piping, Valves, Distributors, and Injection Nozzles.</u>		
5.05.01	Chemical analysis, mechanical tests shall be carried out for materials used for piping, fittings, valves, distributors and injection nozzles.		
5.05.02	All welded joints of distributors & injection nozzles shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.		
5.05.03	Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Valve stem and ball shall be subjected to penetrant test as per ASTM-E165.		
5.05.04	All materials for various nozzles, stubs, gaskets, nuts, bolts etc. shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.		
5.06.00	<u>Rubber Lining (as applicable)</u>		
	Rubber lining shall be subjected to surface crack test, 100% spark and hardness tests and shall be checked for layer thickness, defects etc.		
5.07.00	<u>Flanges</u>		
5.07.01	Chemical and mechanical test certificates shall be furnished for flange materials.		
5.07.02	In case of fabricated flanges, all the welds shall be subjected to 100% radiography as		



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CONDENSER ON - LOAD TUBE CLEANING
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per ASME B&PV code, Section VIII, Division 1.

5.07.03 In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-A 388.

5.07.04 If the thickness of the plate used for flanges is 40mm or more, the same shall be checked ultrasonically as per ASTM-A435 to demonstrate the absence of lamination and lack of fusion etc.

5.07.05 Flanges shall be checked for edge preparation, fit up and satisfactory working with matching parts.

5.08.00 **Dimensional Checks.**

Dimensional checks for various equipments/components of the tube cleaning system shall be carried out as per assembly drawing approved by BHEL. Alignment and fit up of movable parts shall be checked.

5.09.00 **Hydrostatic Test**

Hydrostatic test shall be conducted on various assemblies / equipments / components of the tube cleaning system at a pressure of 1.5 times and design pressure. The duration of the test shall be minimum 30 minutes.

5.10.00 **Leakage Test**

Leakage test shall be conducted at the design pressure on all assemblies of the tube cleaning system to demonstrate that the assemblies are leak tight and no water seepage shall take place at various nozzles and valve connections.

5.11.00 **Performance Test on Recirculating Pump**

Performance test on recirculating pump with drive motor shall be conducted as per BS-599 / ASME PTC 8.0. Performance curves i.e., discharge flow Vs head, discharge flow Vs power consumption and discharge flow Vs efficiency shall be plotted and acceptance norms shall be as per BS-599 / ASME PTC 8.0. Vibration and noise shall be measure and acceptance norms shall be as per Hydraulic Institute (USA) standard.

5.12.00 **Functional Tests**

Various assemblies / equipments / components of the tube cleaning system shall be subjected to functional tests and the following shall be checked.

5.12.01 Smooth and free operation of all movable parts.

5.12.02 Interlock and sequential operation.

5.12.03 Satisfactory operations of ball monitoring system.



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5.12.04 Satisfactory operations of actuators torque switches, limit switches etc.

6.00.00 **TESTING AT SITE**

After completion of installation at site, the tube cleaning system will be tested to check that the tube cleaning system performance meets the requirements of this specification. Rectification of all defects shall have to be done by the supplier at no extra cost to the owner / purchaser. However, the owner / purchaser reserves the right to reject the equipments / parts not meeting the requirement if the deficiency still persists.

7.00.00 **QUALITY ASSURANCE & QUALITY PLAN**

7.01.00 The tube cleaning system and other accessories to be supplied, shall have assured quality and workmanship.

7.02.00 Typical quality plans are enclosed herewith this specification for bidder's guidance. The bidder shall furnish his own quality plan based on materials, equipments and components of the tube cleaning system being offered.

8.00.00 **NAME PLATE AND TAG NUMBERS**

8.01.00 Ball separator, recirculating pump, ball collector shall be provided with a permanently attached brass or stainless steel plate indicating the following details :-

- a) Design and maximum flow rates.
- b) Design and test pressures.
- d) Design temperature.
- e) Empty and operating weights.

8.02.00 Each valve in the tube cleaning system shall be provided with a name plate indicating the following :-

- a) Service.
- b) Design and test pressures.
- c) Maximum flow and flow direction.
- d) Size.
- e) Tag Number.

Tag Numbers will be indicated on the drawings submitted for approval during contract stage.

8.03.00 Each motor shall be provided with a name plate indicating the following details:

- a) Supply conditions.
- b) KW Rating.
- c) Make.



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1.00.00 **DRAWING, DATA & INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT.**

After the award of contract, the following drawings, data and information is to be submitted for review / approval of BHEL.

1.01.00 The drawings to be submitted by bidder in event of award of contract shall be as per cl. 10.0 (b), sub-section-1A.

1.01.01 Data sheet (s) - B.

1.01.02 Final versions of the following drawings to enable BHEL to finalise the layout and to design foundations and structures:-

- a) General arrangement / installation drawings of ball separator, ball recirculating unit, control panel each complete with all accessories, incorporating the principal dimensions and weights of equipment offered, size and location of various nozzle connection, supporting arrangement (wherever applicable) and scope of supply etc.
- b) Foundation arrangement drawings (wherever applicable) showing load data on supports, size and location of anchor bolts etc.
- c) General arrangement drawing indicating the layout of the equipments and interconnecting piping with pipe supports.

1.01.03 Bar chart and inspection schedule.

1.02.00 Within the stipulated time period as per Vendor's drawing /document list, the following shall be submitted.

1.02.01 Cross Sectional/ detailed drawing of ball separator, recirculating pump, ball collector, differential pressure measuring system, ball monitoring system distributors, injection nozzles actuators, motors, control panel etc, indicating bill of quantities and materials of construction.

1.02.02 Final versions of calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc.

12.2.03 Flow and control logic diagrams for various operations of the tube cleaning system.

1.02.04 Detailed schedule of valves indicating Tag numbers, type, make size, pressure and temperature ratings, materials etc.

1.02.05 Detailed schedule of instruments indicating tag numbers, type, make, materials , of construction, range and accuracy etc.

1.2.6 Detailed schedule of piping and fittings indicating sizes, materials, maximum working pressure and temperatures etc.



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- 1.02.07 Control panel layout and list of instruments provided on control panel.
- 1.02.08 List of annunciations, protections and interlocks provided.
- 1.02.09 Detailed drawings of flanges.
- 1.02.10 Ball recirculating pump performance characteristic curves.
- 1.02.11 Write-up and instruction manuals for erection, operation and maintenance.
- 1.02.12 Storage instructions.
- 1.02.13 Vendor to send 3 sets of final documents (O&M manual, GA drg, P&ID) direct to site under intimation to PEM.

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC. NO		PE-1S-417/435-165-N002		DATE:	
CUSTOMER PROJECT:			SYSTEM:				CW SYSTEM		SECTION:		DATE: 28.02.2020	
ITEM: COLTCS			CW SYSTEM				SECTION:		SHEET 01 OF 12		DATE: 28.02.2020	
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks		
1	2	3	4	5	6	7	8	9	M	10	11	
1.0.0	Ball Separator				M	CN						
1.1.0	Raw Material											
[a]	Housing Shell, Nozzle flanges	Chemical properties & Physical MA Surface defects	MA	Chemical Analysis & Mechanical test Visual	One sample/cast 100%	Approved dig/Data sheet Approved dig/Data sheet	Approved dig/Data sheet Approved dig/Data sheet	Test Certificate / Lab test report	V	V		
	Sub Surface Defects	MA	Ultrasonic test	100%	ASME SA 435	ASME SA 435	Inspection report	V	P	V	Plates > 20mm Thk only (U.T. - Full Volume)	
[b]	Nozzle Pipes	Chemical properties & Physical MA Surface defects	MA	Chemical Analysis & Mechanical test Visual	One sample/heat 100%	Approved dig/Data sheet Approved dig/Data sheet	Approved dig/Data sheet Approved dig/Data sheet	Test Certificate / Lab test report	V	P	V	
	Leak Tightness	MA	Hydrostatic test	100%		Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate	V	P	V	
[c]	Main Flange	Chemical properties & Physical MA Heat treatment (Normalising) Surface defects	MA	Chemical Analysis & Mechanical test Verification	One sample/cast 100%	Approved dig/Data sheet Approved dig/Data sheet	Approved dig/Data sheet Approved dig/Data sheet	Test Certificate Inspection report	V	P	V	If casting
	Sub-surface defects	CR	Ultrasonic test	100%	ASME SA609 / SA 435	ASME SA609 Level II / SA 435 / SA 388	Inspection report	V	P	V	V	
[d]	Screen Shaft	Chemical properties & Physical MA	MA	Chemical Analysis & Mechanical test	One sample/heat 100%	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate / Lab test report	V	P	V	

ENGINEERING		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL	
Sign & Date	Name	Sign & Date	Name	Sign & Date	Doc No.	Sign & Date	Name
Prepared by: <i>[Signature]</i>	Nishant Sekhar	Checked by: <i>[Signature]</i>	Ashish Panigrahi	Seal		Prepared by:	
Reviewed by: <i>[Signature]</i>	Vishal Kumar Yadav	Reviewed by: <i>[Signature]</i>	R K Jaiswal			Reviewed by:	

CHANDAN MAITY



QUALITY PLAN

SPEC. NO	PE-TS-417/435-165-N002
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DATE _____

CUSTOMER: _____

PROJECT: _____

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SECTION:

SHEET 02 OF 12

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check		Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks
					M	C/N				D ^a	M	C	
1											10	11	
	Surface defects on machined area	CR	Penetrant test	100%	ASME Sec.VIII Div.1	Appendix 8	Inspection report	V	P	V	V		
		CR	Ultrasonic test	100%	ASME SA745	ASME SA745	Inspection report	V	P	V	V		
		MA	Chemical Analysis & Mechanical test	One sample / One sample / heat	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate / Lab test report	V	P	V	V		
		MA	Corrosion Resistance	OneHeat	ASTM A 923	ASTM A 923	Test Report/Lab test report	V	P	V	V		
[e]	Screen ribs	MI	Visual	100%	Approved dig/Data sheet	Approved dig/Data sheet	Inspection report	V	P	V	V		
		MA	Chemical Analysis & Mechanical test	One sample / One sample / cast/heavt batch	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate / Lab test report	V	P	V	V		
		MI	Visual	100%	Approved dig/Data sheet	Approved dig/Data sheet	Inspection report	V	P	V	V		
		MA	Leak Tightness	100%	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate	V	P	V	V		
[f]	traction Nozzle Pipe Duplex Stainless Steel	MA	Hydrostatic Test	100%	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate	V	P	V	V		
1.2.0	Inprocess Quality Control												
1.2.1	Welding procedure specification	Correctness	CR	Sectility	100%	ASME Sec.IX	ASME Sec.IX	QV 482 of ASME Sec IX	V	P	V	V	
1.2.2	Welding procedure qualification	Weld soundness	CR	Physical test	100%	ASME Sec.IX	ASME Sec.IX	QV 483 of ASME Sec.IX	V	P	V	V	Welding procedure already approved by BHEL/RQA/G/DNN/TUV shall be employed to this job.
1.2.3	Welder performance qualification	Weld soundness	CR	Radiography	100%	ASME Sec.IX	ASME Sec.IX	QV 484 of ASME Sec.IX	V	P	V	V	Welders already qualified by BHEL/RQA/G/DNN/TUV shall be employed for this job.
1.2.4	Fit-up of butt weld	Alignment and dimensions	MA	Template, visual	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Log book	V	P	WMV	-	BHEL to witness > 20mm thick butt joint
1.2.5	Fit-up of shell flange and nozzle assembly to shell	Orientation, alignment and dimensions	MA	Template, visual	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Log book	V	P	-	-	

ENGINEERING		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
BHEL									
Sign & Date	Name	Sign & Date	Name	Sign & Date		Doc No:	Sign & Date	Name	Seal
Prepared by: <i>[Signature]</i>	Nishant Sakhar	Checked by: <i>[Signature]</i>	Ashish Pangrathi	Seal			Prepared by:		
Reviewed by: <i>[Signature]</i>	Vishal Kumar Yadav	Reviewed by: <i>[Signature]</i>	R K Jaiswal				Reviewed by:		



MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS

QUALITY PLAN

CUSTOMER :
PROJECT :
ITEM: COLTCS
SYSTEM: CW SYSTEM

SPEC. NO PE-7S-417/435-165-N002
OP NO.: PE-QP-417-165-N002
PO NO.:
DATE: 28.02.2020
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Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks
1	Weld quality for Pressure Parts	3	4	5	6	7	8	9	M 10	11
1.2.6	Weld quality for Pressure Parts									
	[a] Root run	Surface defects	MA	Penetrant test/ Visual	100%	ASME Sec.VIII Dv.1 Appendix 8	ASME Sec.VIII Dv.1 Appendix 8	Operation Process Sheet	V	V
		1.Surface defects	MA	Penetrant test	100%	ASME Sec.VIII Dv.1 Appendix 8	ASME Sec.VIII Dv.1 Appendix 8	Inspection report	V	V
1.2.7	[a] Completed built welds	2.Sub-surface defects	CR	Radiography test	10% of total weld length & 100% T weld joints	ASME Sec.VIII Dv.1 Appendix 8	ASME Sec.VIII Dv.1 Appendix 4/UM 52	Radiographs & Inspection report	V	V
	[b] Completed fillet welds	Surface defects	MA	Penetrant test	100%	ASME Sec.VIII Dv.1 Appendix 8	ASME Sec.VIII Dv.1 Appendix 8	Inspection report	V	V
		1.Dimensions, Orientation	MA	Measurement by visual	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	V	V
1.2.8	Fabricated Shell (Prior to sand blasting)	2. Hydro test	CR	Hydrostatic Pr. @ 1.5 times design pr. (positive) Duration 30 minutes	100%	ASME Sec.VIII Dv.1	No Leakage	Inspection report	V	V
		Protection Layer	MA	Visual	100%	IS : 10117	IS : 10117	Log Book	P	-
1.2.9	Pickling and Passivation	1.Dimensions, orientation, workmanship & finish	MA	Measurement by visual	100%	G.A.drawing	G.A.drawing	Inspection report	V	P
1.2.10	Final tests (completed equipments) - After assembly	2.Leak tightness for assembly	CR	Leak Tightness @ design pr. (positive) Duration 30 minutes	100%	ASME Sec.VIII Dv.1	No Leakage	Inspection report	V	P
		3.Dry function test for Ball Separator	CR	Operational test	100%	Approved procedure	Approved procedure	Inspection report	V	P

ENGINEERING			QUALITY			BIDDER/ SUPPLIER			FOR CUSTOMER REVIEW & APPROVAL		
Prepared by	Sign & Date	Name	Checked by	Sign & Date	Name	Sign & Date	Doc No.	Sign & Date	Seal		
Reviewed by		Nishant Sakhar	Checked by		Ashish Panigrahi						
by		Yadav	Reviewed by		R K Jaiswal						

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC. NO		PE-15-417/435-165-N002		DATE:	
CUSTOMER: -----			PROJECT: -----				OP NO.:		PE-OP-417-165-N002		DATE: 28.02.2020	
ITEM: COLTCS			SYSTEM: -----				CW SYSTEM		SECTION:		SHEET 04 OF 12	
Sl. No.	Component / Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks
1		Checked							M	C	N	
1.3.0	Rubber Lining for ball Separator Shell, V-piece & skid IC Pipe-(Applicable for Sea Water application)				M	C/N						
1.3.1	Rubber formulation	Tensile elongation and hardness	MA	Physical test	One per lot	Manufacturer's procedure	BS 6374/Equivalent	Manufacturer's test certificate	V	P	V	V
		Polymer Identification	MA	Flame test	One per lot	For Same Ebonite catches fire, catches fire and On removal from fire it continues to burn	For Same Ebonite catches fire, catches fire and On removal from fire it continues to burn	Inspection report	V	P	V	V
1.3.2	Surface preparation of items to be lined	% Change in weight after 24 hrs immersion in sea water at 70 degrees	MA	Immersion test (bleeding test)	One per lot	ASTM D 471	+/- 1 %	Inspection report	V	P	V	V
		Free from rust, scale, dust and grease	MA	Visual	100%	SA 2.5	SA 2.5	Inspection report		P	-	-
1.3.3	Vulcanising	Temperature, Pressure and time	MA	Process monitoring	100%	Manufacturer's procedure	Manufacturer's procedure	Process Procedure		P	-	-
		a) Chip test	MA	Chip test	One per lot	Approved drawing BS 6374/Equivalent	BS BS 6374/Equivalent	Inspection report	V	P	V	V
1.3.4	Vulcanised rubber lined flanges	b) Adhesion, Visual defects, thickness and hardness	MA	Measurement, Visual inspection	100% visual	Approved drawing BS 6374/Equivalent	BS BS 6374/Equivalent	Inspection report	V	P	V	V
		c) Spark test for Pin holes at 3 kv/mm	MA	Spark test for Pin holes	100%	Approved drawing BS 6374/Equivalent	BS BS 6374/Equivalent	Inspection report	V	P	V	V

ENGINEERING		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
Sign & Date	Name	Sign & Date	Name	Sign & Date	Doc No.	Sign & Date	Name	Seal	
Prepared by: <i>Arun Kumar</i>	Mishant Sekhar	Checked by: <i>Ashish Panigrahi</i>	Ashish Panigrahi			Prepared by:			
Reviewed by: <i>Geetha</i>	Vishal Kumar Yadav	Reviewed by: <i>R K Jaiswal</i>	R K Jaiswal			Reviewed by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC. NO.		PE-IS-417/435-165-N002		DATE:		
CUSTOMER :			PROJECT :				CW SYSTEM		SECTION:		DATE: 28.02.2020		
ITEM: COLTCS			SYSTEM:				CW SYSTEM		SECTION:		DATE:		
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Form of Record	DP	M	C	N	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.4.0	Complete Unit of Worm gear	Reduction Ratio Angle of Rotation Input Torque Output Torque	CR	Functional Test	100%	Approved Data Sheet	Approved Data Sheet	Test Certificate	V	P	V	V	
		Degree of protection	CR	Water & Dust ingress tests	Type test	Approved Data Sheet	Approved Data Sheet	Type test certificate	V	P	V	V	
		Routine Test	MA	Electrical test	100%	Supplier catalogue	Supplier catalogue / Approved Data Sheet	Test Certificate	V	P	V	V	Review of TCs
		Make, Range, Model	MA	Visual	100%	Supplier catalogue	Supplier catalogue / Approved Data Sheet	Inspection Report	V	P	V	V	
1.5.0	Actuators	Assembly check alongwith ball valves	MA	Visual	100%	Supplier catalogue	Supplier catalogue / Approved Data Sheet	Inspection Report	P	P	-	-	
		Functional check alongwith settings/auxiliary contacts	MA	Visual	100%	Supplier catalogue	Supplier catalogue / Approved Data Sheet	Inspection Report	P	P	-	-	

ENGINEERING		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
Sign & Date	Name	Sign & Date	Name	Sign & Date	Doc No.	Sign & Date	Name	Seal	
Prepared by: <i>[Signature]</i>	Meharant Sekhar	Checked by: <i>[Signature]</i>	Ashish Panigrahi						
Reviewed by: <i>[Signature]</i>	Vishal Kumar Yadav	Reviewed by: <i>[Signature]</i>	R K Jaiswal						

			MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC. NO		PE-17S-417/435-165-N002		DATE:																														
Sl. No.			Component / Operation			Characteristics Checked			Class			Type of Check			Quantum of Check			Reference Documents			Acceptance Norms			Format of Record			Agency			Remarks														
1			2			3			4			5			6			7			8			9			10			11														
2.0.0			Complete Skid																																									
2.1.0			Ball Vessel																																									
2.2.0			Raw Material																																									
2.2.1			Housing Shell, Nozzle flanges and dish end			Chemical properties & Physical properties			MA			Chemical Analysis & Mechanical test			One sample/heat			One sample/heat			Approved dryData sheet			Approved dryData sheet			dryData sheet			Test Certificate / lab test report			V			P			V			V		
2.2.2			Welding procedure qualification			Surface defects			MA			Visual			100%			100%			Approved dryData sheet			Approved dryData sheet			Test Certificate/Inspection report			V			P			V			V					
2.2.3			Welding performance qualification			Sub-surface defects			MA			Ultrasonic test			100%			100%			ASME SA 435			ASME SA 435			Inspection report			V			P			V			V					
2.2.4			Dished end for ball vessel			Correctness			CR			Scrutiny			100%			100%			ASME Sec IX			ASME Sec IX			QW 482 of ASME Sec IX			V			P			V			V					
2.2.5			Welding procedure qualification			Weld soundness			CR			Physical test			100%			100%			ASME Sec IX			ASME Sec IX			QW 483 of ASME Sec IX			V			P			V			V					
2.2.6			Welder performance qualification			Weld soundness			CR			Radiography			100%			100%			ASME Sec IX			ASME Sec IX			QW 484 of ASME Sec IX			V			P			V			V					
2.2.7			Dimensions			MA			Temple			100%			100%			Manufacturing Drawing			ASME Sec VIII Div.1			ASME Sec VIII Div.1 Appendix 8			Inspection report			V			P			V			V					
2.2.8			Surface defects			CR			Penetrant test			100%			100%			ASME Sec VIII Div.1			ASME Sec VIII Div.1			Inspection report			V			P			V			V								
ENGINEERING			Name			Sign & Date			Name			Seal			Doc No.			Sign & Date			Name			Seal			FOR CUSTOMER REVIEW & APPROVAL																	
Prepared by: <i>[Signature]</i>			Name: Anshant Sakhar			Sign & Date: <i>[Signature]</i>			Name: Ashish Panigrahi			Seal: <i>[Seal]</i>			Doc No.:			Sign & Date:			Name:			Seal:			FOR CUSTOMER REVIEW & APPROVAL																	
Reviewed by: <i>[Signature]</i>			Name: Vistal Kumar			Sign & Date: <i>[Signature]</i>			Name: R K Jaiswal			Seal: <i>[Seal]</i>			Doc No.:			Sign & Date:			Name:			Seal:			FOR CUSTOMER REVIEW & APPROVAL																	



MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS

QUALITY PLAN

CUSTOMER: _____
PROJECT: _____
ITEM: COLTCS

SPEC. NO. PE-TS-417/435-165-N002
QP NO.: PE-QP-417-165-N002
PO NO.: _____
DATE: 28.02.2020
SECTION: _____
SHEET 08 OF 12

Sl. No.	Component / Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks
1	2	3	4	5	6	7	8	9	M C N	11
2.2.5	Fit-up of butt weld	Alignment and dimensions	Major	Measurement	100%	Manufacturing Drawing	ASME Sec VIII Div. 1	Log book	V	BHEL to witness > 20mm thick butt joint.
2.2.6	Fit-up of shell, flange and nozzle assembly to shell	Orientation, alignment and dimensions	Major	Template, Visual	100%	Manufacturing Drawing	ASME Sec VIII Div. 1	Log book	V	
2.2.7	Weld quality for Pressure Parts									
	[a] Root run	Surface defects	MA	Penetrant test / Visual	100%	ASME Sec VIII Div. 1 Appendix 8	ASME Sec VIII Div. 1 Appendix 8	Operation Process Sheet	V	
		1. Surface defects	MA	Penetrant test	100%	ASME Sec VIII Div. 1 Appendix 8	ASME Sec VIII Div. 1 Appendix 8	Inspection report	V	
2.2.8	[a] Completed butt welds	2. Sub-surface defects	CR	Radiography test	10% of total weld length & 100% T joints	ASME Sec VIII Div. 1 Appendix 4 / UW 52	ASME Sec VIII Div. 1 Appendix 4 / UW 52	Radiographs and inspection report	V	RT films will be reviewed by BHEL.
	[b] Completed fillet welds	Surface defects	MA	Penetrant test	100%	ASME Sec VIII Div. 1 Appendix 8	ASME Sec VIII Div. 1 Appendix 8	Inspection report	V	
		1. Dimensions, Orientation	MA	Measurement	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	V	
2.2.9	Fabricated Shell	2. Hydro test for Ball Vessel	CR	Hydrostatic P. @ 1.5 times design pr. (positive) (Duration 30 minutes)	100%	ASME Sec VIII Div. 1	No leakage	Inspection report	V	Hydrostatic test shall be conducted along with Recirculating sldd Assy for Ball Vessel.
2.2.10	Picking and Passivation	Protection Layer	MA	Visual	100%	IS : 10117	IS : 10117	Log Book	V	
		Chemical Physical properties	MA	Chemical & mechanical tests	One sample/heat	Approved dry/Data sheet	Approved dry/Data sheet	Mill Test Certificate / Lab test report / raw material flow sheet	V	
2.2.11	Ball Injection Pipe	Surface defects	MI	Visual	100%	Approved dry/Data sheet	Approved dry/Data sheet	Test Certificate/Inspection report	V	
		Leak Tightness	MA	Hydrostatic test	100%	Approved dry/Data sheet	Approved dry/Data sheet	Test Certificate	V	

ENGINEERING			QUALITY			BIDDER/ SUPPLIER			FOR CUSTOMER REVIEW & APPROVAL		
Sign & Date	Name	Checked by	Sign & Date	Name	Seal	Doc No:	Sign & Date	Name	Seal		
Prepared by: <i>A. Anand Kumar</i>	Mishant Sekhar	Checked by: <i>A. Anand Kumar</i>	28.02.2020	Ashish Pangrati							
Reviewed by: <i>Vishal Kumar</i>	Vishal Kumar	Reviewed by: <i>R. K. Jaiswal</i>	28.02.2020	R. K. Jaiswal							

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS					QUALITY PLAN					SPEC. NO		PE-TS-417/435-165-N002		DATE:	
CUSTOMER: -----					PROJECT: -----					OP NO.:		PE-QP-417-165-N002		DATE: 28 02 2020	
ITEM: COLTOS					SYSTEM: -----					CW SYSTEM		SECTION:		DATE: -----	
SHEET 08 OF 12															
Sl. No.	Component/ Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency		Remarks				
1	2.30 BALL RECIRCULATING PUMP				M	C/N			D	M	10	C	N		
2.31	Casing	Chemical/Physical properties	MA	Chemical & Physical analysis	One Sample/Cast Heat	Approved dry Data sheet	Approved dry/ Data sheet	Test Certificate	V	P	V	V			
2.32	Impeller, Sleeve	Physical and Chemical properties	MA	Physical and Chemical analysis	One Sample/Cast Heat	Approved dry/ Data sheet	Approved dry/ Data sheet	Test Certificate	V	P	V	V			
2.33	Shaft	Physical and Chemical properties	MA	Physical and Chemical analysis	One Sample/Cast Heat	Approved dry/ Data sheet	Approved dry/ Data sheet	Test Certificate	V	P	V	V			
2.34	In-process control	Sub-Surface defects	MA	Ultrasonic Test	100%	ASME SA 745	ASME SA 745	Test Certificate/ Inspection report	V	P	V	V			Only for shaft >= 50mm
2.35	Casing	Leak tightness	CR	Hydro. test @ 1.5 times design pr. (positive) (Duration 30 minutes)	100%	Manufacturing Standard	No Leakage	Inspection report	V	P	V	V			
2.36	Shaft	Surface defects	CR	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	V	P	V	V			
2.37	Impeller	Residual static, dynamic imbalance	MA	Static/dynamic balancing	100%	ISO:1940	ISO:1940, Gr.6.3	Inspection report	V	P	V	V			
2.38	All components	Workmanship, finish and dimensions	MA	Measurement, visual examination	100%	Manufacturing drawing	Manufacturing drawing	Log book / job card		P	-	-			
2.39	Assembly, control, final inspection / test														
	Performance Test	a) Q Vs. Head, Q Vs. Pumps efficiency / overall efficiency, Q Vs. Power, Vibration and Noise b) Dimensions, workmanship and finish c) Noise level Completeness, correctness, cleanliness	CR	Performance test	100%	Approved curve, approved data sheet, IS:5120	Approved data sheet	Inspection report, plotted curves	V	P	V	V			
									V	P	V	V			
2.3.10	Complete pump		MA	Visual examination	100%	Approved data sheet / Mfg. Dwg.	Approved data sheet / Mfg. Dwg.	Check list/ inspection report	V	P	V	V			

ENGINEERING		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL	
Prepared by:	Sign & Date	Name	Sign & Date	Name	Sign & Date	Name	Seal
Reviewed by:		Nishant Sekhar		Ashish Panigrahi			
by:		Vishal Kumar Yadav		R K Jaiswal			

12/22/2019

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS										QUALITY PLAN									
										CUSTOMER: _____									
										PROJECT: _____									
										ITEM: COLTCS									
SYSTEM: _____										CW SYSTEM									
SPEC. NO										PE-TS-417/435-165-N002									
QIP NO.:										PE-QP-417-165-N002									
PO NO.:										DATE: 28.02.2020									
SECTION:										DATE: _____									
SHEET 11 OF 12																			
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	M	C	N	Remarks							
1	Ball Oversize Monitoring								10			11							
4.1.0	Raw Material Housing shell, Flanges	Chemical properties	MA	Chemical Analysis	One sample/heat	Approved sheet	Approved sheet	Mill test Certificate / lab test report/draw material flow sheet	P	V	V	if fabricated type							
		Physical properties	MA	Physical test	One sample / cast/heat/ batch	Approved sheet	Approved sheet	Mill test Certificate / lab test report/draw material flow sheet	P	V	V								
		Surface defects	MI	Visual	100%	Approved sheet	Approved sheet	Mill Test Certificate/Inspection report	V	V	V								
4.2.0	Improcess Quality Control	Sub-surface defects	MA	Ultrasonic test	100%	ASME SA 435	ASME SA 435	Mill Test Certificate	V	V	V	Plates > 20mm Thk only (UT - Full Volume)							
4.2.1	Welding procedure specification	Correctness	CR	Scrubby	100%	ASME Sec.IX	ASME Sec.IX	QW 482 of ASME Sec.IX	V	P	V	Welding procedure already approved by BHEL/RAQ/CDNW/TUV shall be employed for this job.							
4.2.2	Welding procedure qualification	Weld soundness	CR	Physical test	100%	ASME Sec.IX	ASME Sec.IX	QW 483 of ASME Sec.IX	V	P	V								
4.2.3	Welder performance qualification	Weld soundness	CR	Radiography	100%	ASME Sec.IX	ASME Sec.IX	QW 484 of ASME Sec.IX	V	P	V	Welders already qualified by BHEL/RAQ/CDNW/TUV shall be employed for this job.							
4.2.4	Fabricated Shell	1.Surface defects (fill welds) 2.Dimensions, Orientation 3. Hydro test	MA	Penetrant test Measurement by visual Hydrostatic P. @ 1.5 times design P. (sovere) (Duration 30 minutes)	100% 100% 100%	ASME Sec.VIII Div.1 Appendix 8 Approved doc/ Data sheet	ASME Sec.VIII Div.1 Appendix 8 Approved documents / Data sheets	Inspection report Inspection report Inspection report	V V V	P P W	V V V	Hydrostatic test shall be conducted alongwith Reassembling skid assembly							
		4. Functional Test	MA	Functional	100%	Approved procedure	Approved procedure	Inspection report	V	P	V	Functional test to be done at site							
BHEL																			
QUALITY																			
BIDDER/ SUPPLIER																			
FOR CUSTOMER REVIEW & APPROVAL																			
Doc No.:																			
Sign & Date																			
Name																			
Seal																			
Prepared by:																			
Reviewed by:																			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC. NO		PE-TS-417/435-165-N002		DATE:		
CUSTOMER :			PROJECT :		SYSTEM :		CW SYSTEM		SECTION :		DATE: 28.02.2020		
ITEM : COLTOS			ITEM : COLTOS		SYSTEM :		CW SYSTEM		SECTION :		DATE: SHEET 12 OF 12		
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	M	Agency	C	N	Remarks
5.0.0	1 Cleaning Balls 2 Normal balls 3 Abrasive balls	Dimensions	CR	Measurement	Random	Approved Data	Approved Data Sheet	Test Certificate	✓	P	✓	✓	Quantity and type of balls to be checked with data sheets
6.1.0	Internal Fasteners (Duplex Steel)	Chemical & Physical properties	MA	Chemical & Mechanical analysis	1 Per heat/TT Batch	Approved dig/Data sheet	dig/Data sheet	Test Certificate / Lab test report	✓	P	✓	✓	
		Visual workmanship finish	MA	Visual	Sample	Sample	Approved dig/Data sheet	dig/Data sheet	Inspection Report	✓	P	✓	
		Dimensions	MA	Measurement	Sample	Sample	Approved dig/Data sheet	dig/Data sheet	Inspection Report	✓	P	✓	
		Visual Dimensions	MA	Visual	Sample	Sample	Approved dig/Data sheet	dig/Data sheet	Test Certificate / Lab test report	✓	P	✓	
6.2.0	Main Fasteners	Chemical & Physical properties	MA	Chemical & Physical test a) Tensile b) Yield c) Elongation d) Proof load	1 sample per heat	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate / Lab test report	✓	P	✓	✓	
6.3.0	All Components / Equipments	Painting Dry film thickness and visual	MA	Measurement	Random	Painting schedule	Painting schedule	Inspection report	✓	P	✓	✓	
		Packing	MA	Measurement	Random	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate / Lab test report	✓	P	✓	✓	
LEGENDS: RECORDS, IDENTIFIED WITH 'TICK' (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION, ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER, P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE MA: MAJOR, MI: MINOR, CR: CRITICAL NOTE: 1. Photographs of the wooden box (with LR No.) in which items are finally packed as per approved packing procedure is to be submitted to BHEL (wherever applicable) before dispatch. 2. Clearance for dispatch of items will be given only after receipt of above photos. BHEL ENGINEERING QUALITY BIDDER/ SUPPLIER FOR CUSTOMER REVIEW & APPROVAL													
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name	Seal	Doc No:	Sign & Date	Name	Seal			
Reviewed by:		Nishant Sekhar	Reviewed by:		Ashish Panigrahi								

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS		QUALITY PLAN					SPEC. NO.: PE-TS-020-100-M004			DATE: 24.01.2020		
			CUSTOMER :					QP NO.: PE-QP-020-100-M006			DATE: 27.01.2020		
			PROJECT:					PO NO.: LATER			DATE:		
			ITEM: GM BALL VALVES (SIZE 15 TO 50NB/ PN16), FSS/FCS BALL VALVES (SIZE 15 TO 50NB / CLASS 800) & CSS/CCS (SIZE 65 TO 200 NB/ CLASS 150)			SYSTEM: L.P. VALVES		SECTION: II			SHEET 1 OF 4		
SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	* D	**			
					M C/N					M	C	N	

1.0	MATERIALS												
1.1	BODY, END PIECES BALL, SPINDLE, GLAND, LEVER, FASTENERS	1. PHYSICAL, CHEMICAL PROPS.	MA	PHYSICAL, CHEM. TESTING	ONE PER BATCH/ LOT/ HEAT	APPD. DRG. / REL. STD.	APPD. DRG./ REL. STD.	MILL T.C.	√	P/W	V	-	CORRELATION REQD. FOR BODY & END PIECES W.R.T. HEAT Nos.
		2. HEAT TREATMENT	CR	REVIEW OF H.T. RECORDS	100%	-DO-	-DO-	H.T. INTERNAL INSPN. RECORDS	√	P/W	V	-	
		3. SURFACE DEFECTS	MA	VISUAL	100%	MSS-SP-55	FREE FROM DEFECTS	INSPN. REPORT	√	P/W	V	-	
1.2	BODY, END PIECES	1. SURFACE DEFECTS	CR	PENETRANT TEST	100%	ASTM E 165	ANSI B 16.34	TEST REPORT	√	P/W	V	-	APPLICABLE ONLY FOR SS CASTINGS.
1.3	GEAR BOX												
1.3.1	GEAR, WORM GEAR & SHAFT	1. PHYSICAL, CHEMICAL PROPS.	MA	PHYSICAL, CHEM. TESTING	ONE PER BATCH	REL. STD./ DATA SHEET/ MFG. DRG.	REL. STD./ DATA SHEET/ MFG. DRG.	T.C.	√	P/W	V	V	
		2. HARDNESS	MA	MEASUREMENT	100%	REL. STD./ DATA SHEET/ MFG. DRG.	REL. STD./ DATA SHEET/ MFG. DRG.	T.C.	√	P/W	V	V	
1.3.2	GEAR BOX ASSEMBLY	1. APPEARANCE	MA	VISUAL	100%	DRG./DATA SHEET	DRG./DATA SHEET	INSPN. REPORT	√	P/W	V	V	
		2. PERFORMANCE	MA	OPERATION TEST	100%	DRG./DATA SHEET	DRG./DATA SHEET	SUPPLIER T.C.	√	P/W	V	V	
		3. DIMENSIONS	MA	MEASUREMENT	100%	REL STD./ DATA SHEET/ MFG. DRG.	REL STD./ DATA SHEET/ MFG. DRG.	INSPN. REPORT	√	P/W	V	V	
1.3.3	DESIGN VERIFICATION OF GEAR BOX	1. TORQUE CAPABILITY	MA	TESTING (TORQUE AT TWICE OF RATED TORQUE OF GEAR BOX)	ONE/ TYPE/MODEL/ RATED TORQUE	APPROVED PROCEDURE	APPROVED PROCEDURE	T.C.	√	P/W	V	V	REFER NOTE No. 1

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		Rahul Kadam	Checked by:		Krishna Kumar Yadav			Reviewed by:			
Reviewed by:		Sweta Singhal	Reviewed by:		Ritesh Kumar Jaiswal			Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS		QUALITY PLAN					SPEC. NO.: PE-TS-020-100-M004		DATE: 24.01.2020	
			CUSTOMER :					QP NO.: PE-QP-020-100-M006		DATE: 27.01.2020	
			PROJECT:					PO NO.: LATER		DATE:	
			ITEM: GM BALL VALVES (SIZE 15 TO 50NB/ PN16), FSS/FCS BALL VALVES (SIZE 15 TO 50NB / CLASS 800) & CSS/CCS (SIZE 65 TO 200 NB/ CLASS 150)			SYSTEM: L.P. VALVES		SECTION: II		SHEET 2 OF 4	
SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS
1	2	3	4	5	6	7	8	9	* D	** M C N	
					M C/N						

		2. GEAR BOX P.O.D. (LIFE CYCLE TEST)	MA	CYCLE TESTING	ONE/ TYPE/MODEL/ RATED TORQUE		APPROVED PROCEDURE	APPROVED PROCEDURE	T.C.	√	P/W	V	V	REFER NOTE No. 1
2.0	IN PROCESS INSPECTION													
2.1	MACHINING OF ALL COMPONENTS	1. DIMENSIONS	MA	MEASUREMENT	100%		MFG. DRG.	MFG. DRG.	LOG BOOK	-	P/W	-	-	
		2. SURFACE FINISH	MA	VISUAL	100%		MFG. DRG.	MFG. DRG.	LOG BOOK	-	P/W	-	-	
		3. HARDNESS (FOR BALL AND SPINDLE)	MA	HARDNESS TESTING	100%		APPD. DRG. / REL. STD.	APPD. DRG. / REL. STD.	T.C.	√	P/W	V	V	
		4. SURFACE DEFECTS	CR	PENETRANT TEST	100%		ASTM E 165	ANSI B16.34	T.C.	√	P/W	V	-	FOR BALL, SPINDLE SEATS & MACHINED SURFACES.
3.0	BEFORE GALVANISING - SHELL TEST FOR PRESSURE PARTS (FOR CS VALVES ONLY)													
3.1	BODY, END PIECES (PRESSURE PARTS)	LEAK TIGHTNESS	CR	HYDRAULIC TEST	100%		APPD. DRG.	NO LEAKAGE	T.C.	√	P/W	V	-	
4.0	HOT DIP GALVANIZING OF CARBON STEEL BODY, END PIECES AND ALL OTHER CARBON STEEL VALVE PARTS	1. FREEDOM FROM SURFACE DEFECTS	MA	VISUAL	100%		IS:2629	IS:2629	INSPN REPORT	√	P/W	V	-	
		2. UNIFORMITY IN THICKNESS	MA	THICKNESS	VALVE BODY AT RANDOM		IS:2629	IS:2629	INSPN REPORT	√	P/W	V	V	THICKNESS 50 MICRONS (MIN.) TO BE CHECKED WITH ELCOMETER ##
		3. ADHESION	MA	KNIFE TEST	-DO-		IS:2629	IS:2629	INSPN REPORT	√	P/W	V	V	
5.0	ASSEMBLY OF ALL VALVE													
5.1	BALL AND SEAT	MIRROR FINISH (BALL)	CR	BUFFING/ GRINDING/ MACHINING	100%		THE SURFACE SHALL BE SMOOTH AND SHALL HAVE UNIFORM CONTACT WITH SOFT SEAT		LOG BOOK	√	P/W	V	V	
6.0	FINAL TESTING													
6.1	ASSEMBLY	1. DIMENSIONS	MA	MEASUREMENT	100%	10% #	APPD. DRG.	APPD. DRG.	INSPN. REPORT	√	P/W	W	W	

BHEL					BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY		Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name			Sign & Date	Name	Seal
Prepared by:		Rahul Kadam	Checked by:		Krishna Kumar Yadav		Reviewed by:			
Reviewed by:		Sweta Singhal	Reviewed by:		Ritesh Kumar Jaiswal		Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS		QUALITY PLAN						SPEC. NO.: PE-TS-020-100-M004			DATE: 24.01.2020		
			CUSTOMER :						QP NO.: PE-QP-020-100-M006			DATE: 27.01.2020		
			PROJECT:						PO NO.: LATER			DATE:		
			ITEM: GM BALL VALVES (SIZE 15 TO 50NB/ PN16), FSS/FCS BALL VALVES (SIZE 15 TO 50NB / CLASS 800) & CSS/CCS (SIZE 65 TO 200 NB/ CLASS 150)				SYSTEM: L.P. VALVES		SECTION: II			SHEET 3 OF 4		
SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	* D	**				
					M					C/N	M	C		N

		2. OPENING/ CLOSING	MA	OPERATION	100%	10% #	SMOOTH OPERATION OF VALVE	SMOOTH OPERATION OF VALVE	-DO-	√	P/W	W	W	
			MA	TORQUE TESTING	100%	10% #	TORQUE CALCULATIONS	TORQUE WITHIN CALCULATED VALUE	-DO-	√	P/W	W	W	For 200NB size valve
		3. APPEARANCE: WORKMANSHIP, ORIENTATION, MARKING, TAG No.	MA	VISUAL	100%	10% #	APPD. DRG.	APPD. DRG.	INSPN. REPORT	√	P/W	W	W	
6.2	BODY	1. LEAK TIGHTNESS	CR	HYDRAULIC TEST	100%	10% #	APPD. DRG.	NO LEAKAGE	T.C.	√	P/W	W	W	
6.3	SEAT	1. LEAK TIGHTNESS	CR	-DO-	100%	10% #	-DO-	-DO-	-DO-	√	P/W	W	W	
		2. LEAK TIGHTNESS	CR	PNEUMATIC TEST	100%	10% #	-DO-	REL. STD.	-DO-	√	P/W	W	W	
6.4	COMMISSIONING SPARES	WORKMANSHIP & SUITABILITY	MA	VISUAL	100%	100%	-DO-	APPD. DRG.	INSPN. REPORT	√	P/W	W	-	
7.0	PACKING IN WOODEN CASES AND MARKING	SOUNDNESS OF PACKING	MA	VISUAL	100%		APPD. DRG.	APPD. DRG.	SOFT COPY OF PHOTOGRAPHS	-	P	V	-	Vendor to provide the following to BHEL-PEM for verification: a) Photographs of valves duly placed inside the wooden box just before final packing. b) Photographs of the wooden box in which valves have been finally packed just before dispatch. Clearance for dispatch

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		Rahul Kadam	Checked by:		Krishna Kumar Yadav
Reviewed by:		Sweta Singhal	Reviewed by:		Ritesh Kumar Jaiswal

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS		QUALITY PLAN					SPEC. NO.: PE-TS-020-100-M004		DATE: 24.01.2020		
			CUSTOMER :					QP NO.: PE-QP-020-100-M006		DATE: 27.01.2020		
			PROJECT:					PO NO.: LATER		DATE:		
			ITEM: GM BALL VALVES (SIZE 15 TO 50NB/ PN16), FSS/FCS BALL VALVES (SIZE 15 TO 50NB / CLASS 800) & CSS/CCS (SIZE 65 TO 200 NB/ CLASS 150)			SYSTEM: L.P. VALVES		SECTION: II		SHEET 4 OF 4		
SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS	
1	2	3	4	5	6	7	8	9	* D	**		
					M					C/N	M	
												of valves will be given only after receipt of the photos of valves in satisfactory condition as mentioned above.

NOTE:

- REVIEW/ VERIFICATION OF TEST REPORT/CERTIFICATE, IN CASE THESE TESTS HAVE BEEN CARRIED OUT EARLIER (WITHIN THE LAST 5 YEARS FROM PLACEMENT OF PROJECT SPECIFIC PO, BASED ON FRAMEWORK AGREEMENT) ON THE IDENTICAL MODEL/TYPE/RATING OF GEAR BOX, AT AN INDEPENDENT LABORATORY OR WITNESSED BY REPUTED CUSTOMER LIKE NTPC ETC. OR THIRD PARTY INSPECTION AGENCY LIKE LLOYDS, TUV, DNV ETC. IF THE ABOVE TEST REPORTS/CERTIFICATES ARE NOT AVAILABLE OR NOT FOUND SATISFACTORY BY BHEL/CUSTOMER, THEN THE REQUIRED TYPE TESTS TO BE CARRIED OUT BY THE VENDOR ON GEAR BOX WITHOUT ANY COMMERCIAL IMPLICATIONS AT HIS OWN COST & WITNESSED BY BHEL/CUSTOMER.
- BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST, IF REQUIRED.

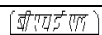
The extent of check to be witnessed is 10% or min. 2nos. at random by BHEL/CUSTOMER & 100% by vendor for each size, type & rating of valve for project specific PO quantity.

Minimum thickness of galvanizing may vary based on project specific requirement, which shall be informed project wise.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER (BHEL)/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		Rahul Kadam	Checked by:		Krishna Kumar Yadav			Reviewed by:			
Reviewed by:		Sweta Singhal	Reviewed by:		Ritesh Kumar Jaiswal			Approved by:			

	QUALITY PLAN			CUSTOMER:			PROJECT:			SPEC. NO :PE-TS-415-100-M008		
				BIDDER/VENDOR:			QAP NO.PE-QP-415-100-M020		REV.00 DTD. 22.12.2018		SPEC. TITLE TWO WAY BUTTERFLY VALVE	
	SHEET 1 OF 5			SYSTEM WATER SYSTEM LP VALVES			ITEM: BUTTERFLY VALVES			SECTION II		
S.N O.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE GORY	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V		REMARKS	

1.	MATERIALS											
1.1	BODY, DISC, SHAFT	1 MECH./CHEM PROPERTIES	MA	CHEM & PHYS. TESTS	ONE/ HEAT/ BATCH	APPD DRG/ TECH SPEC	APPD DRG/ TECH SPEC	TEST CERT.	3/2	2	1	- CORRELATION REQUIRED FOR BODY DISC - FOR CI ONLY MECH. PROPERTIES
		2.DIMENSIONS	MA	MEASURE- MENT	100%	TECH. SPEC	TECH SPEC	LOG BOOK	2	2	1	
		3. SUB-SURFACE DEFECTS OF SHAFT	CR	UT(**)	100%	ASTM A388	ASTM A388	TEST CERT.	3/2	2	1	DIA 40 MM & GREATER
		4. CASTINGS SURFACE DEFECTS	CR	1) VISUAL	100%	MSS SP55	MSS SP55	--DO--	3/2	2	1	
				2) MPI	100%	ASTM E-709/165	NO DEFECTS	--DO--	3/2	2	1	
				3) DPT	100%	ASTM E165	-DO-	-DO-	3/2	2	1	
				4) RT	100%	ASM E B16.34	ASM E B16.34	-DO-	3/2	2	1	- RT ON SS VALVES (FILM REVIEW BY BHEL)
		5. HEAT TREATMENT	MA	REVIEW OF HT RECORD	100%	TECH. SPEC	REL. MATL. STD	MATL. T.C	3/2	2	1	- SOLUTION ANNEALING FOR OTHER MATL. AS PER REL. SPEC
1.2	SOFT SEAT CLAMPING RING & SOFT SEAT S.S. MATING SEAT	1)CHEM., PHYS PROPS	MA	CHEM. PHYS TESTS	1/HEAT	TEST SPEC/ APPD DATA SHEET	TECH SPEC/ APPD DATA SHEET	LAB REPORT	3/2	2	1	
		2) INTERNAL DEFECTS	MA	UT TEST(**)	100%	ASTM A388	ASTM B16.34 APPENDIX-IV	TEST CERT	3/3	2	1	FOR S.S MATING SEAT THICKNESS 25MM & ABOVE
		3) VISUAL INSPN	MA	VISUAL	100%	TECH. SPEC	NO DEFECTS	TEST CERT.	3/2	2	1	
		4)CHEMICAL TESTING OF BODY SEAT RING, MATING SEAT (SS)	CR	IGC TEST	1/HEAT/BA TCH	ASTM A262	ASTM A262 PRACTICE 'E'	TEST REPORT	3/2	2	1	
1.3	SOFT SEAT	1. VISUAL INSPN	MA	VISUAL	100%	TECH. SPEC/	TECH. SPEC/	LOG BOOK	3/2	2	1	

BHEL	PARTICULARS	BIDDER/VENDOR	
PRABHJYOT SINGH	NAME		
	SIGNATURE		
	DATE		
			BIDDER'S/ VENDOR'S COMPANY SEAL

	QUALITY PLAN			CUSTOMER:			PROJECT:			SPEC. NO :PE-TS-415-100-M008		
				BIDDER/VENDOR:			QAP NO.PE-QP-415-100-M020		REV.00 DTD. 22.12.2018		SPEC. TITLE TWO WAY BUTTERFLY VALVE	
	SHEET 2 OF 5			SYSTEM WATER SYSTEM LP VALVES			ITEM: BUTTERFLY VALVES			SECTION II		
S.N O.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE GORY	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V		REMARKS	

		2.DIMENSIONS	MA	MEASURE- MENT	100%	APPD DRG TECH. SPEC	APPD DRG TECH SPEC	LOG BOOK	2	2	1	
		3. TENSILE STRENGTH	MA	TESTING	1. SAMPLE / BATCH	IS:3400(PART-1)	120Kg/CM ² (MIN)	I.R	3/2	3/2	1	
		4.ELONGATION	MA	TESTING	-DO-	IS:3400(PART-1)	250%(min)	I.R	3/2	3/2	1	
		5. HARDNESS	MA	TESTING	-DO-	MFG. STD.	70 ⁰ ±5 ⁰ (Shore-A)	I.R	3/2	3/2	1	
		6. BLEED RESISTANCE	MA	TESTING	-DO-	SAMPLE TO BE KEPT IN 33% HCL, DM WATER, 48% NaOH FOR 72 HRS	NO DISCOLOU- RATION, WEIGHT GAIN ± 0% TO +2%	T.C	3/2	3/2	1	
		7. OZONE RESISTANCE	MA	TESTING	1/ BATCH	ASTM-D-1149	NO CRACKS AT 50 pphm Ozone	TEST CERT	3/2	3/2	1	
		8. AGEING TEST	MA	TESTING	1/ BATCH	ASTMD-573	No deterioration	TEST CERT	3/2	3/2	1	
		9. HYDRAILIC STABILITY TEST AFTER AGING	MA	TESTING	1/BATCH	TECH SPEC./ AWWA C504	TECH SPEC./ AWWA C504	TEST CERT.	3/2	2	1	
1.4	FASTENERS	1. VERIFICATION OF MAKE, GRADE	MI	VISUAL	100%	TECH. SPEC/ DATA SHEET	TECH. SPEC/ DATA SHEET	INSPN REPORT	3	3/2	1	
		2. DIMENSIONS	MA MA	MEASURE- MENT	SAMPL- ING PLAN	RELV STD.	RELV STD.	INSP REPORT	3	3/2	1	
1.5	GEAR BOX	1. CHEM. COMP. & PHYS PROPERTIES	MA	CHEM & PHYS TEST	1/ BATCH	RELV STD/ DATA SHT/ MFG DRG	RELV STD/ DATA SHT/ MFG DRG	TEST CERT	3/2	2	1	
	GEAR, WORM , BUSH & SHAFT	2. DIMENSIONS	MA	MEASURE- MENT	100%	RELV STD/ DATA SHT/ MFG DRG	RELV STD/ DATA SHT/ MFG DRG	INSP REPORT	2	2	1	
		3. HARDNESS(GEAR & WORM)	MA	MEASURE- MENT	100%	RELV STD/ DATA SHT/ MFG DRG	RELV STD/ DATA SHT/ MFG DRG	TEST CERT	3/2	2	1	
		4. <u>DESIGN VERIFICATION</u>										
		a) TORQUE CAPABILITY	MA	TESTING (TORQUE AT TWICE OF RATED TORQUE OF GEAR BOX)	ONE/ TYPE/SIZE/ RATED TORQUE	AWWA C504 CL 4.2.8	AWWA C504 CL 4.2.8	TEST CERT.	3/2	1	-	REFER NOTE

BHEL	PARTICULARS	BIDDER/VENDOR	
PRABHJYOT SINGH	NAME		
	SIGNATURE		
	DATE		
			BIDDER'S/ VENDOR'S COMPANY SEAL



CUSTOMER:

BIDDER/VENDOR:

PROJECT:

QAP NO.PE-QP-415-
100-M020

REV.00

DTD. 22.12.2018

SPEC. NO :PE-TS-415-100-M008

SPEC. TITLE TWO WAY BUTTERFLY VALVE

SHEET 3 OF 5

SYSTEM WATER SYSTEM LP VALVES

ITEM: BUTTERFLY VALVES

SECTION II

S.N.
O.

COMPONENT/
OPERATION

CHARACTERISTICS
CHECKEDCATE
GORYTYPE/
METHOD
OF CHECKEXTENT
OF CHECK

REFERENCE DOCUMENT

ACCEPTANCE
NORMS

FORMAT OF RECORD	
---------------------	--

AGENCY

REMARKS

P W V

BHEL

PRABHJYOT SINGH

PARTICULARS

NAME _____

SIGNATURE

DATE _____

BIDDER/VENDOR

BIDDER'S/ VENDOR'S COMPANY SEAL

	QUALITY PLAN		CUSTOMER:			PROJECT:			SPEC. NO :PE-TS-415-100-M008		
			BIDDER/VENDOR:			QAP NO.PE-QP-415-100-M020		REV.00 DTD. 22.12.2018	SPEC. TITLE TWO WAY BUTTERFLY VALVE		
	SHEET 4 OF 5		SYSTEM WATER SYSTEM LP VALVES			ITEM: BUTTERFLY VALVES			SECTION II		
S.N O.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE GORY	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS
									P	W	V

3.2	DESIGN TESTS VALVE LEAK TIGHTNESS TEST	TEST			SIZE/ CLASS	CL 5.1.4	CL 5.1.4					
		2. LIFE CYCLE TESTING	MA	HYDRO TEST	ONE/TYPE/ CLASS / SIZE GROUP	APPROVED PROCEDURE/ AWWA C504 CL 5.1.4 APPD. DRGS/ RELV STD	APPROVED PROCEDURE AWWA C504 CL 5.1.4 NO LEAKAGE	TEST CERT.	3/2	1*	--	Refer note
		1. SHELL TEST	MA	HYDRO TEST	100%			TEST CERT	2	1	--	Refer note
		2. SEAT LEAKAGE	MA	HYDRO TEST/ AIR TEST (IF AIR TEST SPECIFIED IN APPD DRG)	100%	APPD. DRGS/ RELV STD	NO LEAKAGE	TEST CERT	2	1	--	
3.3	FUNCTIONAL TEST OF ACTUATOR WITH VALVE	1. SETTING OF LIMIT, ,TORQUE SWITCHES & OPERATION	MA	TESTING	100%	TECH SPEC/ APPD.DRG/ APPD DATA SHEET/IS:9334	TECH SPEC/ APPD.DRG/ APPD DATA SHEET/IS:9334	TEST CERT.	3/2	1		
		2. OPERATION TEST WITH POWER SUPPLY ENERGISED,OPEN/ CLOSE & CURRENT DRAWN	MA	TESTING	100%	TECH SPEC/ APPD.DRG/ APPD DATA SHEET/IS:9334	TECH SPEC/ APPD.DRG/ APPD DATA SHEET/IS:9334	TEST CERT.	3/2	1		
3.4	PERFORMANCE TEST	1.VALVE & ACTUATOR PERFORMANCE	MA	**	100%	TECH SPEC/ RELV STD	SMOOTH OPERATION	TEST CERT	2	1		**OPERATING THREE TIMES FROM THE FULLY CLOSED TO THE FULLY OPENED AND THE REVERSE UNDER DESIGN CONDITION, MANUALLY AS WELL AS THROUGH OPERATOR.
4.0 4.1	COMPLETE ASSEMBLY FINAL INSPECTION	1. OVERALL L DIMENSION	MA	MEAS.	100%	APPD DRG		INSPN REPORT	2	1		
		2. CLEANLINESS	MA	VISUAL	100%	APPD DRG/ TECH SPEC		INSPN REPORT	2	2	1	
		3. NAMEPLATE WITH VALVE TAG NOS.	MA	VISUAL	100%	APPD DRG/ TECH SPEC		INSPN REPORT	3/2	2	1	

BHEL	PARTICULARS	BIDDER/VENDOR	
PRABHJYOT SINGH	NAME		
	SIGNATURE		
	DATE		
			BIDDER'S/ VENDOR'S COMPANY SEAL

	QUALITY PLAN		CUSTOMER:			PROJECT:			SPEC. NO :PE-TS-415-100-M008		
			BIDDER/VENDOR:			QAP NO.PE-QP-415-100-M020		REV.00 DTD. 22.12.2018		SPEC. TITLE TWO WAY BUTTERFLY VALVE	
	SHEET 5 OF 5		SYSTEM WATER SYSTEM LP VALVES			ITEM: BUTTERFLY VALVES			SECTION II		
S.N O.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE GORY	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V		REMARKS

5.0	PAINTING	AS PER BHEL TECH. SPEC	MA	VISUAL	100%	AS PER TECH. SPEC.	COMPLAINE REPORTS & PHOTOGRAP H	3/2	2	1	FOR CI VALVES ONLY
6.0	PACKING	SOUNDNESS	MI	VISUAL	100%	AS PER TECH SPECIFICATION	INSP REPORT	2	2	1	PHOTOGRAPHS OF WOODEN CASES HAVING DULY PACKED VALVES TO BE FURNISHED TO BHEL-PEM FOR VERIFICATION TO OBTAIN MDCC

NOTE: REVIEW/ VERIFICATION OF INSPECTION REPORTS / TEST CERTIFICATES, IN CASE THESE TESTS CARRIED OUT EARLIER ON THE IDENTICAL MODEL/TYPE SIZE/CLASS RATING/ SIZE GROUP OF TESTED VALVES, GEAR BOX, ACTUATOR AND WITNESS BY REPUTED CUSTOMER LIKE NTPC OR THIRD PARTY INSPECTION AGENCY LIKE LLOYDS, TUV , DNV ETC. If the same above TCs are not available then the required type tests to be carried out by the bidder on identical valves, electric actuators, gear box without any commercial implications/ at their own cost AND the POD tests shall be witnessed by BHEL/ customer.

ABBREVIATIONS: CHP=CUSTOMER HOLD POINT CR= CRITICAL ACTIVITY MA= MAJOR ACTIVITY PT= DYE PENETRATION TEST P=PERFORMED BY V=VERIFIED BY W= WITNESSED BY (customer at random)
 1= BHEL/TPI 2= VENDOR 3= SUB VENDOR I R= INSPECTION REPORT TC= TEST CERTIFICATE,UT=Ultrasonic test,
 LPI=liquid penetrant inspection, MPI=magnetic particle inspection.

() NORMAL BEAM PROBE OF 20/10MM DIA & 2/2.5 MHz SHALL BE USED. USING THIS PROBE THE BACK WALL ECHO SHALL BE SET AT 100% FULL SCREEN HEIGHT (FSH) IN SOUND AREA. AT THIS SENSITIVITY LEVEL THE ITEM SHALL BE SCANNED & ANY DEFECT ECHO MORE THAN 20% FSH IS NOT ACCEPTABLE. ALSO ANYWHERE COMPLETE LOSS OF BACK WALL ECHO IS NOT ACCEPTABLE**

BHEL	PARTICULARS	BIDDER/VENDOR	
PRABHJYOT SINGH	NAME		
	SIGNATURE		
	DATE		BIDDER'S/ VENDOR'S COMPANY SEAL



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-165-N002** Rev 01

SECTION: **II**

SUB-SECTION: **IIB**

REV. NO. **0** DATE **15.05.20**

SHEET **1** OF **1**

SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 of 2

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/ N				D	M	C	N	
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V*	-	* NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V*	-	* NOTE -1 & NOTE-2

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO :		DATE:
			CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02		DATE: 17.04.2020
			PROJECT:		PO NO.:		DATE:
			ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II		SHEET 2 of 2

		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

NOTES:

1. Routine tests on 100% motors shall be done by the vendor. However, BHEL/ Customer shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
2. For exhaust/ventilation fan motors of rating up to 1.5 KW, only routine test certificates shall be furnished for scrutiny.
3. In case test certificates for these tests on similar type, size and design of motor from independent laboratory are available, the same is valid for 5 years.
4. BHEL reserves the right to perform repeat test, if required.
5. After packing and prior to issue MDCC, photographs of items to be despatched shall be sent to BHEL for review.
6. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

** **M:** SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B:** MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C:** CUSTOMER,

P: PERFORM, **W:** WITNESS, **V:** VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI:** MINOR, **CR:** CRITICAL

D: DOCUMENTATION

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI			Reviewed by:			
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL			Approved by:			



TITLE:
**TECHNICAL SPECIFICATION
COLTCS**

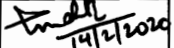
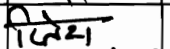
STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-165-N002** , Rev 01
SECTION: **II**
SUB-SECTION: **IIC**
REV. NO. **0** DATE **15.05.20**
SHEET **1** OF **1**

SUB-SECTION - IIC

STANDARD TECHNICAL SPECIFICATION (C &I)

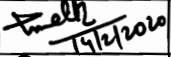
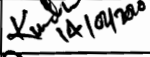
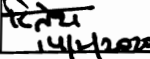
		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			STANDARD QUALITY PLAN				SPEC. NO :		DATE:			
					CUSTOMER :				QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020			
						PROJECT:				PO NO.: --		DATE: --		
						ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 1 OF 9		
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	**			REMARKS
1	2	3	4	5	M	C/N	7	8	9	D	M	C	N	
1.0	RAW MATERIAL Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	✓	P/W	V		
		2. Bend Test	CR	Mech. test	Sample	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	✓	P/W	V		
		3. Surface finish	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	✓	P/W	---		
		4. Waviness	MA	Visual	100%	10%	Manufacturing Standard	No Waviness	Inspection Report	✓	P/W	---		
		5. Thickness	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W	V		
		6. Mill marking	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	✓	P/W	V		
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	Sample	IS:2062	IS:2062	Test Certificate	✓	P/W	---		
		2. Surface Defects	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	✓	P/W	---		
		3. Straightness	MA	Measurement	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	✓	P/W	---		
		4. Mill marking	MA	Visual	100%	10%	IS:2062	IS:2062	Inspection Report	✓	P/W	V		

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		CHE TAN MALIK	Checked by:		KUNDAN PRASAD
Reviewed by:		RK RAINA	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

बी एच ई एल BHEL		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			STANDARD QUALITY PLAN				SPEC. NO :		DATE:			
					CUSTOMER :				QP NO.: PE-QP-999-145-I056		DATE: 07.02.2020			
					PROJECT:				PO NO.: --		DATE: --			
					ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 2 OF 9			
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6		7	8	9	* D	**			
					M	C/N					M	C	N	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
		2. IR and HV	MA	Electrical	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measuremen t Visual	100% 100% 100%	10% 10% 10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
		4. Type / Routine Test Certificates	MA	Verification	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays	1. Verification at make and Type	CR	Visual	Samp le	Samp le	Approved Drg/Datasheet	Approved Drg/Datasheet	Test Certificate	√	P/W			
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			
		3. Operation / Functional check	CR	Electrical	Samp le+ 100% @	Samp le+ 10% @	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			+ for relay & contactors only

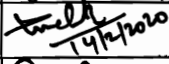
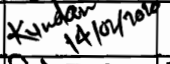
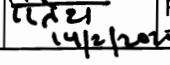
BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		CHETAN MALIK	Checked by:		KUNDAN PRASAD
Reviewed by:		RK RAINA	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
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					ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 3 OF 9	

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
	Timers, Space Heaters, Thermostat, Indicating meters etc.	4. I.R. 5. H.V. 6. Calibration 7. Pick up / Drop off Voltage	MA MA MA MA	Electrical Electrical Electrical Electrical	100% 100% 100% 100%	10% 10% 10% 10%	Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	Inspection Report Inspection Report Inspection Report Inspection Report	√ √ √ √	P/W P/W P/W P/W	V		@ for all components except relays & contactors.
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA MA MA	Visual Visual Electrical	Sample Sample Sample	Sample Sample Sample	Manufacturing Standard Manufacturing Standard Manufacturing Standard	Manufacturing Standard Manufacturing Standard Manufacturing Standard	Test Certificate Test Certificate Test Certificate	√ √ √	P/W P/W P/W			
	IN PROCESS INSPECTION													

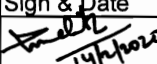
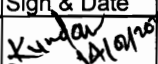
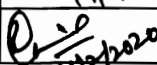
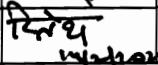
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ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		CHETAN MALIK	Checked by:		KUNDAN PRASAD
Reviewed by:		RK RAINA	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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					PROJECT:			PO NO.: --		DATE: --		
					ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 4 OF 9	

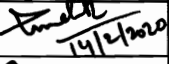
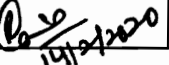
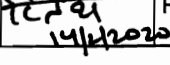
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1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
6.0	Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			
		2. Surface defects after bending	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	✓	P/W			
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			
		2. Deburring	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			
		2. Alignment	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			
		3. Welding Quality	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			
		4. Surface defects	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			

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Reviewed by:		RK RAINA	Reviewed by:		RK JAISWAL

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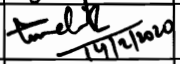
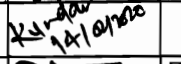
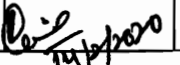
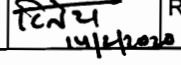
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						ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 5 OF 9	
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**		
					M	C/N				D	M	C	N
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		2. Process parameters like bath temp. concentration etc.	MA	Measuremen t	Perio dic	Perio dic	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		3. Dipping / Removal Time	MA	Measuremen t	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		4. Surface quality after every dip	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		5. Primer after phosphating	MA	Visual, Thickness	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		6. Putty Application & Rubbing after primer	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		7. Paint first coat	MA	Visual, Thickness	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	

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Reviewed by:		RK RAINA	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
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Seal	

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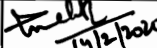
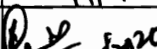
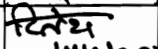
बी एच ई एल BHEL		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			STANDARD QUALITY PLAN				SPEC. NO :		DATE:			
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					PROJECT:				PO NO.: --		DATE: --			
					ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 6 OF 9			
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	* D	**			
					M	C/N					M	C	N	
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		3. Ferrule numbers	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		4. Colour of wiring	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	V		
		5. Size of Conductor	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	V		
11.	Component Mounting	1. Correct components	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		2. Fixing	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			

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Reviewed by:		RK RAINA	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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					CUSTOMER :			QP NO.: PE-QP-999-145-I056		DATE: 07.02.2020				
					PROJECT:			PO NO.: --		DATE: --				
					ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 7 OF 9			
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
12.	FINAL TESTING Final Inspection	1. Workmanship	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	W		At Random by BHEL, based on 100 % internal test reports by Mfr.
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		3. Components identification Marking / Name plates	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		5. Dimensions	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		At Random by BHEL, based on 100 % internal test reports by Mfr.
		6. Door functioning	MA	Functional	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		7. Paint Shade	CR	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		

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					ITEM: LOCAL CONTROL PANEL			SYSTEM: C&I		SECTION: C		SHEET 8 OF 9		
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
		8. Paint Thickness	CR	Measuremen t	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		9. Workmanship of Gaskets	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	W		
		10. Wiring Layout	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		11. Wire Termination	MA	Pulling manually	Samp le	Samp le	----	Firm termination	Inspection Report	√	P/W	W		
		12. Continuity	MA	Electrical	100%	10%	----	Continuity OK	Inspection Report	√	P/W	W		
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Samp le	Samp le	Approved Drg/Datasheet Relevant IS- 13947 Part-1, IS-2148.	Approved Drg/Datasheet Relevant IS- 13947 Part-1, IS-2148.	Type Test Certificate	√	P/W	V		
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	10%	Approved Drg/Datasheet Relevant IS.	Approved Drg/Datasheet Relevant IS.	Inspection Report	√	P/W	W		

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	<i>[Signature]</i> 14/02/2020	CHETAN MALIK	Checked by:	<i>[Signature]</i> 14/02/2020	KUNDAN PRASAD
Reviewed by:	<i>[Signature]</i> 14/02/2020	RK RAINA	Reviewed by:	<i>[Signature]</i> 14/02/2020	RK JAISWAL

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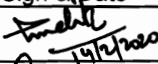
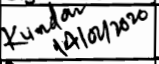
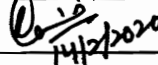
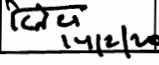
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1	2	3	4	5	6		7	8	9	D	**			
					M	C/N					M	C	N	
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		2. Instrument Calibration	CR	Electrical	10%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		3. Temperature rise	CR	Electrical	100%	10%	Approved Drg/Datasheet Relevant IS.	Approved Drg/Datasheet Relevant IS.	Inspection Report	√	P/W	W		

NOTES:

- Customer's specification for painting shall be included in the technical specification. In the absence of Customer's spec. for painting, vendor to obtain BHEL's approval on their painting specification / procedure.
- Copies of all TC's (Test Certificates) for components shall be submitted to BHEL for verification and acceptance.
- BHEL reserves the right to conduct repeat tests, if required.

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION, D: DOCUMENTATION,
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		CHETAN MALIK	Checked by:		KUNDAN PRASAD			Reviewed by:			
Reviewed by:		RK RAINA	Reviewed by:		RK JAISWAL			Approved by:			



STANDARD CHECK LIST FOR C&I INSTRUMENTS(for MSE& Max pkgs)

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

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

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		VIPUL KUMAR VERMA	Checked by:		KUNAL GANDHI
Reviewed by:		SURESH CHAND SHARMA	Reviewed by:		RITESH KUMAR JAISWAL



STANDARD CHECK LIST FOR C&I INSTRUMENTS(for MSE& Max pckgs)
CHECK LIST FOR PRESSURE & DP GAUGE

Sl. No	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED - DATA SHEETS	P	W	V	
	SENSOR TYPE						
	DIAL SIZE						
	MODEL NO/TAG NO						
	RANGE/SCALE						
	SWITCH CONTACT RATING & NOS.						
	END CONNECTION						
2	CALIBRATION			P	W	V	
	ACCURACY						
	REPEATABILITY						
	SET POINT ADJUSTMENT						
3	OVER PRESSURE & LEAK TEST	P	W	V			
4	OPERATION OF PRESSURE. RELIEF DEVICE	ONE	P	W	V		
5	REVIEW OF TC FOR	FOR LOT	V	V	V		
	MATERIALS OF SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST	V	V	V		
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW	V	V	V		

Legend :

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

Note :

- Quantum of check shall be as below : 100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- When material correlation is not available, MFR's compliance to be provided
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same along with test certificates to be verified by BHEL.

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		VIPUL KUMAR VERMA	Checked by:		KUNAL GANDHI
Reviewed by:		SURESH CHAND SHARMA	Reviewed by:		RITESH KUMAR JAISWAL



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-165-N002**, Rev 01

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 15.05.20

SHEET **1** OF **1**

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER

	TITLE : SCHEDULE OF PERFORMANCE GUARANTEES FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM (COLTCS)	SPEC. NO. PE-TS- 415-165-N002 , Rev01
		SECTION: III
		Sheet 1 of 1 Date- 15.05.20

S.NO.	DESCRIPTION	UNITS	BHUSAWAL – 1X660 MW
1.	Pressure drop across the ball collecting Strainers (i.e. between inlet & outlet nozzle) under clean condition and Normal flow condition	MWC	
2	Percentage of ball recovery	%	
3	Life of sponge rubber balls	Weeks	

Note: In addition to the above, Bidder to comply the guarantee performance requirements specified under ‘General Performance requirement’ indicated in clause no. 3.2 of Section 1A of this specification.

I bidder / authorized representative confirm that all the performance requirements indicated above and at clause no. 3.2 of section 1A have been read and shall be complied during contract.

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE				COMPANY SEAL
NAME	DESIGNATION	SIGNATURE	DATE	

	COMPLIANCE CERTIFICATE FOR COLTCS	SPEC. NO.	PE-TS- 415 i-165-N002 , Rev01
		DATE:	15.05.20
		SHEET	1 OF 2

COMPLIANCE CERTIFICATE

The bidders shall confirm compliance with following by signing/ stamping this compliance certificate and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions with regard to same.
- b) There are no other deviations w.r.t. specification other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer/Customer's Consultant approval and customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself.
- d) Any drawing/ document/ data-sheet/ calculation/ Quality plan/ Instrumentation etc. submitted along with the offers shall be considered for reference only, same shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification. For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares including balls shall be supplied on 'As Required Basis' and to be supplied at the time of commissioning of COLTCS system & prices for same included in the base price itself.
Prices for special tools & tackles, if any, shall also be included in the base price.
Recommended spares for 3 years shall be quoted separately with price indicated separately.
- g) Charges for Installation Checks, Commissioning of equipments, Trial runs and Performance Testing at site shall be included by bidder as per the price format.
- h) The main flanges for Ball separator shall be suitable for the forces and moments as per the specification.
- j) Injection nozzles – 2/4 numbers of stubs of 100 NB or size as informed by bidder shall be provided by BHEL. The injection nozzles, counter flanges for the stubs along with nuts, bolts and gaskets shall be supplied by the bidder.
- k) Number of balls (Normal as well as abrasive) for COLTCS shall be as specified i.e Number of balls per charge shall be @ 10% of no. of tubes per condenser section.
- l) The hydrostatic test pressure shall be 1.5 times the design pressure.
- m) All sub - vendors shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- n) The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer/Customer's Consultant.
- o) The orientation of piping around COLTCS shall be finalised during detailed Engg.
- p) Electrical/ C&I :

	COMPLIANCE CERTIFICATE FOR COLTCS	SPEC. NO.	PE-TS- 415 -165-N002 , Rev01
		DATE:	15.05.20
		SHEET	2 OF 2

- All selected motor ratings have minimum 15 % margin over maximum continuous demand of the driven equipment including voltage and frequency variations, temperature rise and other factors.
- Supply of electrical viz. LT power cables, instrumentation and control cables, cable glands, lugs, cable trays etc. shall be as per specification. Their erection shall be done by BHEL
- The junction boxes for termination of DPT/ DPS/ Actuator LS / solenoid valves/ Ball valve monitor/ Ball recirculating monitor are included in bidder's scope. The instrumentation cable and cabling from instruments/ actuators to junction boxes is also included in bidder's scope.
- Valve actuators and controls shall be provided as specified in Data Sheet-A and Project specific requirements as specified in Sub-Section IB & Section IC.
- Alarms/ annunciations/ instruments shall be finalised during detailed engineering in the event of order which shall be subject to BHEL/ Customer/Customer's Consultant approval and shall be without any commercial implications to BHEL.



Title

DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.

PE-TS-999-165-N001

VOLUME III

PART A

SHEET I

OF 13

INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01

Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.

PARTICULARS

ITEM

UNIT

1.0

General :

1.1

Number of Tube Cleaning System sets
being supplied.

Nos.

1.2

Type

1.3

Liquid handled

1.4

Manufacturer

1.5

Country of origin

2.0

Design :

2.1

Design Pressure

Bar (g)

a) Ball Separator

b) Ball Recirculating Pump

c) Ball Collector

d) Piping

e) Valves

f) Distributors

g) Injection Nozzles

2.2

Design Temperature

°C

2.3

Operating pressure at condenser inlet

Bar (g)

2.4

Design differential pressure

Bar (g)

2.5

Flow rate through ball separator

M³/hr

a) Normal

b) Maximum allowable

2.6

Flow rate through ball collector

M³/hr

a) Normal

b) Maximum allowable

Name of

Bidder/ Vendor

Revision Number

0

1

2

3

4

Signature of Bidder/ Vendor

Authorised Representative

Date



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME	III	PART	A
SHEET	2	OF	13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
3.0	Guaranteed Performance	
3.1	Whether condenser back pressure/overall heat transfer coefficient is guaranteed that it will be permanently maintained as long as the tube cleaning system is in operation.	YES/NO
3.2	Pressure drop across the ball separator (i.e., between inlet and outlet connections) :	
	a) Normal flow condition	
	b) Maximum allowable flow condition	
3.3	Power consumption by ball recirculating pump during :	KW
	a) Normal operation	
	b) Ball collection operation	
	c) Ball sorting operation	
3.4	Quantity of cleaning balls required per set for an operating period of one year	Nos.
4.0	Operation :	
	Whether tube cleaning system is designed for the following operation modes :	
4.1	Automatic start-up initiated by push button.	YES/NO
4.2	Automatic shut-down with ball collection effected by :	
	a) Push button	YES/NO
	b) Adjustable timer	YES/NO
	Ball monitoring system	YES/NO

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative					

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001				
			VOLUME III		PART A		
			SHEET 3		OF 13		
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PES-179-01. Section - D, Volume - IIB. 2. Items which deviate from Specification shall be marked with an asterisk (*)					
SL.NO.	PARTICULARS	ITEM	UNIT				
4.3	Automatic backwashing of ball separator with ball collection effected by :						
	a) Differential pressure measuring system		YES/ NO				
	b) Adjustable timer		YES/ NO				
	c) Push button		YES/ NO				
4.4	Automatic emergency backwashing of ball separator effected by differential pressure measuring system.		YES/ NO				
4.5	Automatic flushing of differential pressure measuring system.		YES/NO				
4.6	Automatic ball sorting initiated by push button.		YES/NO				
4.7	Whether provision for manual operation of the complete tube cleaning system is made in case of control system failure.		YES/NO				
5.0	Ball Separator :						
5.1	Make						
5.2	Nos. provided per set	Nos.					
5.3	Code/ Standard						
5.4	Body outer diameter	mm					
5.5	Body thickness	mm					
5.6	Manhole type & size	mm					
5.7	Whether sight glass is provided						
5.8	No. of screens/ strainers provided per each ball separator	Nos.					
5.9	Type of arrangement provided to prevent lodging of the debris at the entrance of ball extraction pipes.						
Name of Bidder/ Vendor							
Revision Number		0	1	2	3	4	
Signature of Bidder/ Vendor							
Authorised Representative							
Date							



Title

DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.

PE-TS-999-165-N001

VOLUME III

PART A

SHEET 4

OF 13

INSTRUCTION
TO BIDDER

1

This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.

PARTICULARS

ITEM

UNIT

5.10 Clearance between screen/ strainer
bars.

mm

5.11 Materials :

- a) Body/ Housing
- b) screen/ Strainer section
- c) Screen/ Strainer shaft
- d) Hardware for fixing the screen/
Strainer
- e) Other internal hardware
- f) External hardware

5.12. Lining material (if applicable)

6.0 **Ball Recirculating Pump :**

6.1 Make

6.2 Nos. provided per set

Nos.

6.2 Design discharge flow

M³/hr

6.4 Design discharge pressure

Bar

6.5 Design pump Speed

RPM

6.6 Design pump efficiency

%

6.7 Seal for the pump

6.8 Materials :

- a) Casing
- b) Impeller
- c) Shaft

7.0 **Ball Collector :**

7.1 Nos. provided per set

Nos.

Name of
Bidder/ Vendor

Revision Number

0

1

2

3

Signature of Bidder/ Vendor

Authorised Representative



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III PART A
SHEET 5 OF 13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	PARTICULARS	ITEM	UNIT
7.2	Code/ Standard		
7.3	Whether inspection window/ sight glass is provided.		YES/ NO
7.4	Materials : a) Shell/ Body b) Internals		
7.5	Lining material (if applicable)		
7.6	Whether provision for separating and collecting the undersized balls, is made		YES/ NO.
8.0	Differential Pressure Measuring System:		
8.1	Differential Pressure Switch/ Transmitter a) Type b) Make and Model c) Range d) Accuracy e) Material of sensing element f) No. of contacts g) Contact rating h) Enclosure i) Mounting	Nos.	
8.2	Whether differential Pressure gauge is provided for manual observation.		
8.3	Differential Pressure Gauge : a) Type b) Make and Model c) Range		

Name of
Bidder/ Vendor

Revision Number

0

1

2

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4

Signature of Bidder/ Vendor
Authorised Representative



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III **PART** A

SHEET 6 **OF** 13

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01

Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
d) Accuracy		
e) Material of sensing element		
f) No. of contacts	Nos.	
g) Dial size	mm	
h) Enclosure		
i) Mounting		
8.4	Whether the contacts for differential pressure gauge and switch/ transmitter are independent.	YES/ NO
9.0	Timer for Backwashing	
9.1	Timer make	
9.2	Range of duration setting	
9.3	Range of frequency	
10.0	Ball Monitoring System :	
10.1	Type	
10.2	Maake & Model	
10.3	Whether ball monitoring system is designed to perform the following functions :	
	a) Continuously counting the balls in circulation and giving an alarm calling for investigation of ball losses, when the number of circulating balls falls below a set value	YES/ NO
	b) Continuously measuring the size of the balls in circulation and initiating the shut-down of the tube cleaning system with alarm calling for replacement of balls, when the number of oversized balls falls below a set value.	

Name of Bidder/ Vendor

Revision Number

0

1

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4

Signature of Bidder/ Vendor

Authorised Representative

Date



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME	III	PART	A
SHEET	7	OF	13

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01 Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
10.4	Whether electronic processor of the ball monitoring system is provided with the following	
a) Indicators for		
♦ Required basic ball charge		YES/ NO
♦ Recirculating Ball quantity		YES/ NO
♦ Oversized ball quantity		YES/ NO
b) Time counters for		
♦ Total cleaning system operating hours		YES/ NO.
♦ Cleaning system operating hours with sufficient number of oversized balls		YES/NO
c) Recorder for ball consumption		YES/NO
10.5	Whether provision for Self-testing and Self Calibration are made	YES/NO
11.0	Cleaning Balls :	
11.1	Type	
11.2	Size	mm
11.3	Specific gravity	
11.4	Material	
11.5	Hardness	
11.6	Total Ball recirculation quantity per set	Nos.
11.7	abrasive coated ball recirculation quantity per set - (if any)	No.s
12.0	Piping :	
12.1	Ball Extraction Piping	

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor					
Authorised Representative					

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)	SPECIFICATION NO. PE-TS-990-165-N001			
		VOLUME	III	PART	A
		SHEET	8	OF	13

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01 Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	PARTICULARS	ITEM	UNIT
12.2	Ball Transport Piping	a) OD x thicknes b) Material c) Length of piping being supplied	mm x mm M
12.3	Differential pressure measuring system flushing piping.	a) OD x thicknes b) Material c) Length of piping being supplied	mm x mm M
2.4	Any other		
3.0	Valves (Indicate Type of Valves)		
3.1	Sizes		: mm
3.2	Nos. provided per set		Nos.
3.3	Materials		
	a) Body b) Disc/ Trim c) Shaft		
4.0	Distributors		
4.1	Nos. provided per set		Nos.
4.2	Materials :		
	a) Body b) Sight glass c) Sight glass flanges d) Internal parts		

Name of Bidder/ Vendor					
Division Number	0	1	2	3	4
Signature of Bidder/ Vendor					
Authorised Representative					
Date :					



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III PART A
SHEET 9 OF 13

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO. PARTICULARS	ITEM	UNIT
14.3	Lining material (if applicable)	
15.0	Injection Nozzles :	
15.1	Nos. provided per each CW inlet pipe	Nos.
15.2	Size of the stubs to be provided in CW inlet pipe for installing the injection nozzles.	mm
15.3	Material	
15.4	Lining material (if applicable)	
16.0	Actuators :	
16.1	Actuators for ball separator :	
	a) Nos. provided per ball separator	No.s
	b) Type & make	
	c) Motor rating	KW
16.2	Actuators for ball collector	
	a) Nos. provided per ball collector.	No.s
	b) Type & make	
	c) Motor rating	KW
16.3	Actuators for Valves:	
	a) Nos. provided per set	No.s
	b) Type & motor	
	c) Motor rating	KW
16.4	Any other	

Name of
Bidder/ Vendor

Revision Number

0

1

2

3

4

Signature of Bidder/ Vendor
Authorised Representative

Date



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III **PART** A
SHEET 10 **OF** 13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-0:
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
17.0	Electric Drive Motors	
17.1	Drive motor for recirculating pump :	
	a) Type and make	
	b) Rating	KW
17.2	Drive motor for differential pressure measuring system flushing pump (if applicable)	
	a) Type and make	
	b) Rating	KW
17.3	Any other.	
18.0	Control Panel	
18.1	Type	
18.2	Model & Manufacturer	
18.3	Operating Voltage/ frequency	V/ Hz
18.4	Control Voltage/ frequency	V/ Hz
18.5	Materials of housing and door	
18.6	Protections/ interlocks provided for :	
18.7	Class of Protection	
18.8	Control Hardware	
18.8	Alarms/ Annunciations provided for :	
18.9	Indicators provided for :	
18.10	Whether interconnecting control and power cabling between the control panel and various drive is included in the offer.	
19.0	Pressure gauges :	
19.1	Manufacturer & Type, Model	

Name of Bidder/ Vendor

Revision Number

0

1

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3

Signature of Bidder/ Vendor

Authorised Representative

Date



Title **DATA SHEET - B**
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO. **PE-TS-999-165-N001**

VOLUME III PART A
SHEET 11 OF 13

INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01 /
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
19.2	Nos. provided per set	Nos.
19.3	Location	
19.4	Dial size	mm
19.5	Range & Accuracy	
19.6	Materials of construction : a) Sensing element b) Movement c) Casing	
19.7	Enclosure	
19.8	Mounting	
20.0	Counter Flanges :	
20.1	Whether counter flanges complete with gaskets, bolts and nuts etc. for all terminal points are included in the offer.	YES/ NO
20.2	Type	
20.3	Rating	
20.4	Materials a) Flanges b) Bolts and Nuts c) Gaskets	
20.5	Code/ Standard	
21.0	Whether lifting arrangement is provided for various equipments.	YES/ NO.
22.0	Whether ball recirculating pump, ball collector with interconnecting piping and valves are mounted on a single frame.	YES/ NO
23.0	Whether supports (wherever necessary) complete with foundation plates, bolts, nuts, inserts etc. are included in the offer.	YES/ NO

Name of
Bidder/ Vendor

Revision Number

0

1

2

3

4

Signature of Bidder/ Vendor
Authorised Representative

Date :



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III **PART** A
SHEET 12 **OF** 13

INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No PES-179-01 Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	PARTICULARS	ITEM	UNIT
24.0	Shop Inspection and Tests		
24.1	Whether all the tests and inspections as detailed in the specification/ quality plan are carried out.		YES/NO
24.2	Hydrostatic Test :		
	a) Test Pressure	Bar (g)	
	♦ Ball Separator		
	♦ Recirculating Pump		
	♦ Ball Collector		
	♦ Distributors		
	♦ Injection nozzles		
	♦ Piping & Valves		
	a) Test duration	Minutes	
24.3	Lekage Test :		
	a) Test Pressure	Bar (g)	
	b) Test duration	Minutes	
25.0	Painting :		
25.1	External Surfaces :		
	a) Surface Preparation		
	b) Primer		
	a) Finish		
25.2	Internal Surfaces :		
	a) Surface Preparation		
	b) Primer		
	a) Finish		
26.0	Weights :		
26.1	Empty Weight	Kg.	
	a) Ball Separator		

Name of
Bidder/ Vendor

Revision Number

0

1

2

3

4

Signature of Bidder/ Vendor
Authorised Representative

Date

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Title

DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.

PE-TS-999-165-N001

VOLUME

III

PART A

SHEET

13

OF

13

INSTRUCTION
TO BIDDER1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.

ITEM

UNIT

PARTICULARS

- b) Recirculating pump
- c) Ball collector
- d) recirculating unit

26.2

Operating weight

kg

- a) Ball Separator
- b) Recirculating pump
- c) Ball collector
- d) recirculating unit

26.3

Weight of the heaviest equipment/
assembly to be handled.

kg.

27.0

Overall Dimensions

27.1

Ball Separator

27.2

Recirculating Unit

28.0

Other information (if any)

G:\MSEVASH\DS-COTCS.RTF

Name of
Bidder/ Vendor

Revision Number

0

1

2

3

4

Signature of Bidder/ Vendor

Authorised Representative