

1	Motor (LT)	I	MARATHON	KOLKATA	Upto 20 KW No Inspection reqd-Cat-III Above 20 KW Cat-I
		I	SIEMENS	MUMBAI	
		I	KEC	BANGALORE/HUBLI	
		I	CGL	AHMED NAGAR	
		I	ABB	FARIDABAD/BANGLORE	
		I	BBL	MUMBAI	
10	Cable Lug	III	DOWELLS	MUMBAI	
		III	COMETT	MUMBAI	
11	Limit Switch	III	BCH	NEW DELHI	
		III	SIEMENS	NEW DELHI	
		III	ASEA	NEW DELHI	
		III	JAIBALAJI	NEWDELHI	
12	Interposing Relay	III	ECONIX	MUMBAI	
		III	PHEONIX	DELHI	
13	JUNCTION BOXES	III	BALIGA LIGHTING EQUIP	CHENNAI	
		III	CREATIVE INST	BANGLORE	
		III	DEVI POLY	CHENNAI	
		III	INFO CONTROL	BANGLORE	
		III	K.S.INTRUMENTS	BANGLORE	
		III	MANISHA ENTERPRISE	PUNE	
		III	SUCHITRA INDUSTRIES	BANGLORE	
		II	DELTON CABLES	FARIDABAD	
		II	PARAMOUNT CABLES	KHUSKHERA	
		II	RELANCE	BANGLORE	
14	INSTRUMENT CABLE	II	POLYCAB	DAMAN	
		II	UNIVERSAL CABLES	SATNA	
		II	NICCO	KOLKATTA	
		II	CORDS	BHIWADI	
		II	INCAB	PUNE	

	LEGENDS 1. QP/INSPN CATEGORY : CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC. CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP. CAT -III : For these items main supplier approves the quality plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier. UNIT/WORKS : Place of manufacturing Place of Main Supplier of multi units/works
	NOTE-1 For steel following modalities to be adopted a) Steel plate, structural steel and section shall be procured from main producers like SAIL/ TISCO/ ISSCO/ RINL/ JINDAL/ ESSAR/ ISPAT/ LLOYD'S STEEL/ JSW. b) Material will be delivered directly from manufacturer's plant/ stock yard/ godown to NTPC project site. c) Correction of material with MTC will be done by main contractor before delivery and correlated MTC along with delivery challan will be NTPC-RIO for issuance of MDCC. NOTE-2 It that the same Quality Plans as approved for main equipment and identified in the vendor list shall be applicable for the type of control measure i.e. make /test/ check the procurement of mandatory spares. However, for those spares which are not covered in the approved QP, main supplier shall furnish Certificate of Conformance (COC) along with guarantee and interchangeability certificate shall be generated by the main item manufacturer, for which the spares are made. NOTE-3 A) LESS THAN 30 KW:- Acceptance of motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows: It is here confirmed that the above mentioned motor/ motors was / were manufacture taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing/ data sheet B) 30 KW AND ABOVE & UPTO 50 KW:- Acceptance of Motor rating between 30 KW & 50 KW is based on NTPC review of Routine Test inspection report as per IS 326 witnessed by main contractor along with COC of the manufacturer & the contractor confirming as follows: It is hereby confirmed that the above mentioned motor / motors was /were manufactured taking care of NTPC specific requirements regarding ambient temperature, voltage and frequency variations, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing / data sheet.

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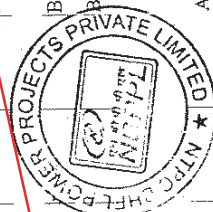
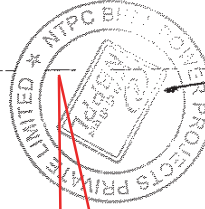
PROJECT: FGUTPP-IV (1 x 500 EPC(SG))
CONTRACTOR: BHEL (NTPC) (S&P ED 13)
CONT NO: CS-1450-001-9

LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL

Ref No: 1450-001-9-QQG-R-012
Revision No: 00
Date: 3/17/2011

SUB SYSTEM: Electrical and C&I for Boiler and Auxiliaries

SR NO	ITEM	QP /INS- /PN CAT	QP NO.	QP SUB- QP MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
1	DDCMS (Sub-Ex Item)	I	QVI-Q-001		BHEL	Bangalore	A			BHEL in house supply, systems as approved by NTPC Engg
2	Acoustic Coal Flow Detector	III			Stock	USA	Noted			
		III			Merik	USA	Noted			
3	Acoustic Pyrometer	II	QVI-Q-002		Stock	USA	A			
		II			Scientific Engg	USA	A			
4	Air Filter Regulator	III			BHEL Approved Sources		Noted			
5	Annunciator & SER, HART Blank Cabinets.	III			BHEL Approved Sources		A			
6	Annunciator System	III			Rochester	UK	A			
		III			Procon	Chennai	A			
		II	QVI-Q-003		Procon Engg	UK	A			Through their system integrator
		II			Instrotech	South Africa	A			
		I			BHEL	Trichy	A			
		I	QVI-Q-004		BHEL	Bangalore	A			BHEL in house supply, systems as approved by NTPC Engg
9	Battery (Ni-Cd)	I	QVI-Q-005		Amco soft	Bangalore	A			
		I			HBL Nife Power Systems	Hyderabad	A			



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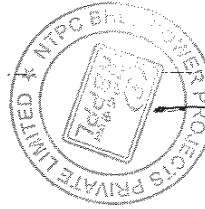
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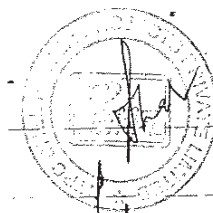
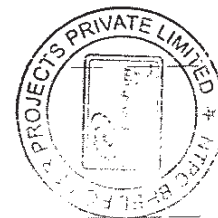
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SR NO	ITEM	QP /INS- -PN CAT	QP NO. 1450-001-9 CAT	QP SUB- QP MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
18	Compression Fittings	III			HP Valves and Fittings	Chennai	DR			
19	Computer Furniture	III			Featherlite	Bangalore	Noted			
		III			PAN Office System	India	Noted			
		III			OTS Office Take	India	Noted			
		III			Godrej & Boyce	Mumbai	Noted			
		III			Pyrotech	Udaipur	Noted			
20	Condensing Pots	III			BHEL Approved Sources		A			
21	Control Box (Mill Insert System)	III			BHEL System		Noted			
22	Control Box -Soot Blower, Starter Box, Seamer Pan Box,	III			BHEL Approved Sources					
23	Control Valve	I	QVI-Q-010		Fisher Xomox	Chennai	A			For atomising / fuel oil application
		II			Kumbe	Germany	A			
		II			CCI	USA/SWED EN / AUSTIA/ KOREA / SWITZERLA ND	A			
		II			Emerson (Fisher Controls)	USA / France	A			
		II			Dresser Masonellan	France	A			
		II			SAMSON	PUNE	A			
		I			Dresser Valve India	Coimbatore	A			
		II			Nippon Fisher (EMERSON)	Japan	A			
		II			Copes Vulcan	UK	A			
		I			MIL controls India	Alwaye	A			



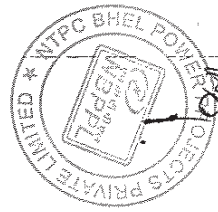
For atomising / fuel oil application



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SR NO	ITEM	QP /INS- NO. /PN 1450-001-9 CAT	QP SUB-MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHED ULE	SC APPL SCHED ULE	REMARKS
23	Control Valve	I QV1-Q-010		Instrumentation Ltd	Palghat	A			
24	Copper Tubing / Brass Connectors	III		BHEL Approved Sources		A			
25	Coupling Relays	III		Elesia	Switzerland	A			
		III		Oen	Cochin	A			
		III		Omron	Japan / China	A			
		III		ABB (H & B)	Germany	A			
		III		Iyoti	Baroda	A			
		III		Paramount	Bangalore	A			
26	Crimping Lugs, Cable Glands, Conduit	III							REFER LIST 1450-001-QOE-R44
27	DC Link Reactor for VFD	I QV1-Q-011		Hind Rectifier	Mumbai	A			
		I		Trench Electric	Canada	A			
		I		SUDHIR INTRA VIDYUT	BANGALORE	A			
		I		BHEL	Jhansi	A			
28	DC Motor	I QV1-Q-012		CGL	Ahmed Nagar	A			
		I		Kirloskar Electric	Bangalore / Hubli	A			
		III		Weigell Messgerate	Germany	A			
29	Digital Indicators	III		Gossen / Metrowatt / Camille Bauer	Germany	A			
		III		Yokogawa	Japan	A			
		III		Foxboro	UK	A			
		III		ABB	Germany	A			
		III		Masibus	Gandhi Nagar	A			
30	Digital Tachometer	III		BHEL System		Noted			

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APPENDIX-E (MOM-QA)

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SR NO	ITEM	QP /INS- PN CAT *	QP NO. 1450-001-9	QP SUB- MISSION SCHEDU -LE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED U.E	SC APPL SCHED ULE	REMARKS
31	E/P Converter or I/P Converter	III	QVI-Q-013		ABB	GERMANY	A			Subject to meeting the NTPC Spec. requirement.
		III			FAIRCHILD	USA	A			
		III			ECKARDT	GERMANY	A			
		III			IMI Norgren (Watson Smith Instrumentation)	UK	A			
		III			MTL	CHENNAI	A			Make - Watson Smith, UK
		*			SMC	NOIDA	DR			* Inspection category will be decided during evaluation.
32	Electrical Actuator (With Gear Box)	II	QVI-Q-014		Rotork India	Chennai	A			GEAR BOX FROM ROTORK UK FOR MULTITURN & BROQ SERIES FOR QUARTER TURN FROM ROTORK CHENNAI
		I			Limitork	Faridabad	A			
		II			Limitork	USA	A			
		II			Rotork	UK	A			
		I			Rotork India	Bangalore	A			GEAR BOX FROM ROTORK UK FOR MULTITURN & BROQ SERIES FOR QUARTER TURN FROM ROTORK CHENNAI
		II			Auma	Germany	A			
		II			Auma India	Bangalore	A			
		II			Nippon Gear	Japan	A			

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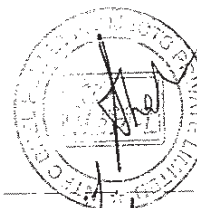
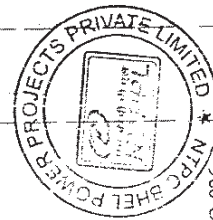
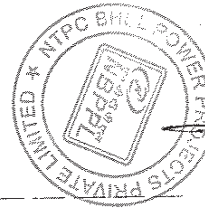
SR NO	ITEM	QP /INS- NO- PN CAT	QP NO. 1450-001-9	QP SUB- QP MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
33	Electrical Control Panels (ACCSP, RPC, FIC, Chemical Dosing, etc)	I	QVI-Q-015		Ganz	Germany	A			REF LIST 1450-001-QOE-R-45
34	Electrical Indicating Instruments (Mosaic Compatible)	III			Gossen / Metrowatt / Camille Bauer	Germany	A			
		III			Weigell Messgerate	Germany	A			
35	ERV Controllers	I	QVI-Q-016		BHEL	Trichy	A			
36	ERV Pressure Switch	III			Barksdale	USA / UK / Germany	A			
		III			Dressor (Ashcroft)	USA / UK	A			
37	EWLI	II	QVI-Q-017		Solartron	UK	A			
		II			Yarway	USA	A			
		II			BHEL	Trichy	A			Electrodes from BHEL EPD Bangalore
38	Pneumatic Field Controller and Transmitter	III			Yokogawa	Japan / USA	A			
		III			ABB Instrumentation Ltd	Faridabad	A			
		III			ABB (CE)	USA	A			
		III			Yokogawa	Japan / USA	A			
		III			BHEL	Trichy	A			FLAME SCANNER AMPLIFIER EDN MAKE . QP BY TRICHY.
		III			BHEL System		Noted			
		III			BHEL System		Noted			
42	Flame Scanner Head Assembly Test Kit	II	QVI-Q-018							REFER LIST 1450-001-QOE-R44
43	Flexible Cable Trays Support									

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SR NO	ITEM	QP /INS- NO- PN CAT *	QP NO. 1450-001-9	QP SUB- QP MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
50	Gravimetric Feeder Components Load Cell	III			Stock	USA	A			
51	Gravimetric Feeder Controls with Panel	I	QVI-Q-023		BHEL	Trichy	A			
52	Impulse Pipes / Tubes	II			Stock	USA	A			
		III			Sumitomo / Kawasaki / Japan Nippon	Japan	A			
		III			Maharashtra Seamless (CS only)	Raigarh	A			
		III			TPS Technitube	Germany	A			
		III			Veluric & Manessmann	Germany	A			
		III			BHEL	Trichy	A			
		III			Trouvay & Cauvin	France	A			
		III			ISMT (CS Only)	Ahmed Nagar	A			
		III			BHEL	Trichy	A			
53	Instrument Valves	II	QVI-Q-025		BALDOTA	MUMBAI	A			
		II			Excel Hydro	Mumbai	A			
		II			Instrumentation Ltd	Palghat	A			
		II			HYD AIR	LONAVALLA	DR			
		II			Forbes Marshall	Pune	DR			
		II			IHP Control Valves and Fittings	Chennai	DR			
54	Intelligent Battery Charger 24 V dc & DCDB	I	QVI-Q-026		Masstek Electricals	Jalgaon	A			
		I			Eltek	Gurgaon	A			
		I			Chhabhi Electricals	Jalgaon	A			
55	Junction Box	III			BHEL Approved Sources					



REF NOTE 1 AT
LAST PAGE

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APPENDIX-E (MOM-QA)

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SR NO	ITEM	QP /INS-NO. -PN 1450-001-9 CAT	QP SUB- MISSION SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
56	Level Gauge	III		V Automat	New Delhi	A			UPTO 40 KG/CM2
		III		Pune Techtrol	Pune	A			UPTO 40 KG/CM2
		III		Chemtrols	Goa	A			UPTO 40 KG/CM2
		III		Levcon	Calcutta	A			UPTO 40 KG/CM2
		III		Krohne	Germany	A			
		III		E&H	Germany	A			
		III		Sigma	Mumbai	A			UPTO 40 KG/CM2
		III		SBEM	Pune	A			
57	Level Switch (Capacitance Type, Water)	III							
		III		PUNE TECHTROL	PUNE	A			
		III		E&H	Germany	A			
		III		LEVCON	KOLKATA	A			
		III		Nivo	Indore	A			
		II	QV1-Q-028	BHEL	Trichy	A			
58	Level Switch (Conductivity Type)	II		Solartron (Mobrey)	UK	A			
		II		Yarway	USA	A			
		II		Levelstate	UK	A			
		III		Pune Techtrol	Pune	A			(UPTO 40 Kg/Cm2)
59	Level Switch (Float / Displacer Type)	III							
		III		Sigma	Mumbai	A			(UPTO 40 KG/CM2)
		III		Delta Controls	UK	A			
		III		V Automat	New Delhi	A			(UPTO 40 Kg/Cm2)
		III		ISA Controls	UK	A			
		III		Mswzuiker	UK	A			
		III		Gauges Bourdon	Panvel	A			(UPTO 40 KG/CM2)
		III		Foxboro	UK	A			

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SR NO	ITEM	QP /INS. NO. -PN 1450-001-9	QP /INS. CAT	QP SUB- MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
74	Office Plate Assembly	III	III	III	Cartodynamics	Hyderabad	Noted			
		III	III	III	Engineering Specialties	Kolkata	Noted			
		III	III	III	Baliga	Chennai	Noted			
		III	III	III	Wellwin Industries	Chennai	Noted			
		III	III	III	Placa	Chennai	Noted			
		III	III	III	Micro Precision	Fardabad	Noted			
		III	III	III	ISA Controls	UK	Noted			
		III	III	III	Instrumentation Ltd	Palghat	Noted			
		III	III	III	ABB (H&B)	UK	Noted			
		III	III	III	Technomatic	Italy	Noted			
		III	III	III	Telemechanique	France	A			
75	Output Contactor	III	III	III	IBM / Lenovo		Noted			
76	OWS	III	III	III	Compag / HP		Noted			
		III	III	III	DELL		Noted			
77	Panel Mounted Items of BDCMIS / AVR & VFD Panel Not Listed Above	III	III	III	BHEL Approved Sources		A			
78	Passenger cum Goods Elevator	I	I	I	ICE	GHAZIABA D	A			
		I	I	I	TECHNO INDUSTRIES	Ahmedabad	A			
		I	I	I	Otis	Mumbai	A			
		I	I	I	SAMIL ELTEC	KOREA	A			
		I	I	I	Kone	Chennai	A			
		I	I	I	Schindler	Mumbai	DR			
		I	I	I	Johnson	Chennai	DR			
79	PLC System	I	I	I	Schneider	New Delhi	A			

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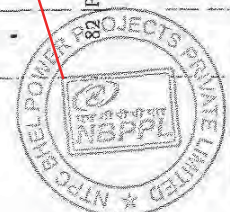
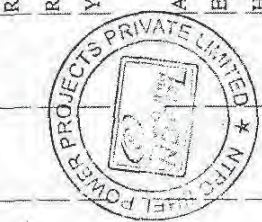
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SR NO	ITEM	QP /INS- NO. /PN CAT *	QP NO. 1450-001-9	QP SUB- MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS /CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
79	PLC System	I	QVI-Q-037		GE Intelligent Plateforms	Bangalore	A			
		I			ABB	Bangalore	A			
		I			Rockwell Automation (AB)	Sahibabad	A			
		I			Seimens	Nasik	A			
80	Positive Displacement Flow Meter / Transmitter	II	QVI-Q-038		Brooks	USA	A			
		I			Toshniwal Hyvac	Chennai	A			
		II			Oval	Japan	A			
		II			Bopp & Routhier	Germany	A			
		*			Rockwin Flow Meter Indian Pvt Ltd	New Delhi	DR			* - Inspection Category will be decided during evaluation
81	Power Cylinder (Pneumatic Actuator / SADC)	I	QVI-Q-039		SMC	Noida	A			
		I			Keltron	Cochin (Alleppy)	A			
		I			Instrumentation Ltd	Palghat	A			
		II			RGS Electro Pneumatic	UK	DR			
		I			Rotex Manufacturers	Vadodara	DR			
		II	QVI-Q-040		Yokogawa	Japan	A			Calibration at M/s YIL Bangalore is also acceptable 2600 T series
		II			ABB	Italy	A			
		II			Emerson process mgt.	Daman	A			
		II			Honeywell	U.S.A.	A			
		II			Emerson process mgt.	U.S.A.	A			
		II			Fuji Electric	Japan	A			

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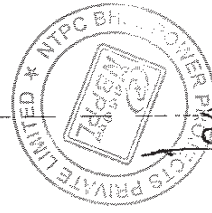
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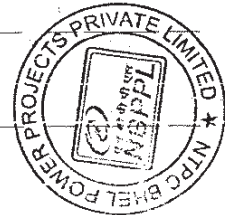
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SR NO	ITEM	QP /INS- -PN CAT	QP NO. 1450-001-9	QP SUB- MISSION SCHEDULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
82	Pressure / DP / Flow Transmitters	I	QV1-Q-040		ABB	Faridabad	A			2600 T series
83	Pressure / DP / Draft Gauge / Pr. Gauge With Needle Valve (Other Than MS & FW)	III			Waree Instruments	Mumbai	A			
		III			Bells Controls	Kolkata	A			
		III			A N Instruments	Narendrapur	A			
		III			Gluck	Mumbai	A			
		III			Goa Thermostatic	Goa	A			With imported Bourden Tube for Pressure Gauge
		III			Nievo Fima	Italy	A			
		III			Wika	Germany	A			
		III			Manometer India Pvt Ltd	Mumbai	A			
		III			GIC	Mumbai / Goa	A			
		III			Auxitrol	UK	A			
		III			Switzer (For DP & Draft)	Chennai	A			
		III			H Guru Instruments (South India Pvt Ltd)	Bangalore	A			
		III			Budenberg	UK	A			
		III			Dressor (Ashcroft)	USA / Germany	A			
		III			Nagano Keiki	Japan	A			
		III			Helicoid	USA	A			
		III			Wika	India	DR			
		III			Aim Tech Process Analytical Industries	USA	DR			
		III			Precision Instruments	Mumbai	DR			



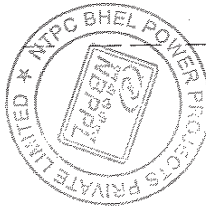
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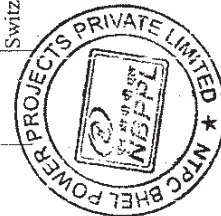
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84	Pressure / DP / Draft Gauges (Feed Water and Main Steam Line Application)	III	1450-001-9			Dressor (Ashcroft)	USA / Germany	A			
		III				Wilka	Germany	A			
		III				Budenberg	UK	A			
		III				Nagano Keiki	Japan	A			
		III				Auxitrol	UK	A			
		III				Helicoid	USA	A			
		III				Am Tech Process Analytical Industries	USA	DR			
85	Pressure / DP / Temperature Switch (For Furnace Pressure Application)	II	QV1-Q-041			KDG	UK	A			
		II				Delta Controls	USA	A			
		II				Barton Instrument System	USA	A			
		II				Dressor (Ashcroft)	USA/ Germany	A			
		II				SOR	USA	A			
		II				Regulator Georgin	France	DR			
86	Pressure / DP / Temperature Switch (Other than Furnace Pressure Application)	II	QV1-Q-042			Barton Instrument System	USA	A			
		II				Switzer	Chennai	A			



BHEL to submit customer reference list

upto 40 Kg/cm2 & 200 C, not for compound switch application & Except 900 series pressure switch

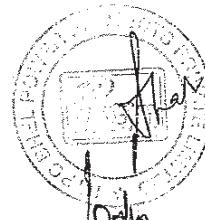
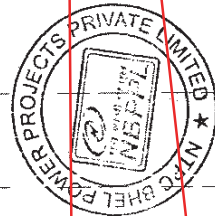
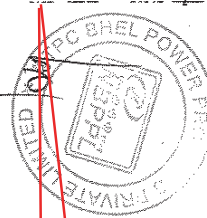


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ENGINEERING DIV / QAI

01201

SR NO	ITEM	QP /INS-NO. /PN CAT	QP NO. 1450-001-9	QP SUB- MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS /CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
86	Pressure / DP / Temperature Switch (Other than Furnace Pressure Application)	II	QVI.Q-042		Infos	Chaziabad	A			upto 40 Kg/cm2 & 200 C, not for compound switch application
		II			Herion	Germany	A			
		II			Delta Controls	UK	A			
		II			SOR	USA	A			
		II			KDG	UK	A			
		II			Dressor (Ashcroft)	USA / Germany	A			
		II			Universal Electric	USA	DR			
		II			Regulator Georgin	France	DR			
					Vasu Tech	Riwari	DR			Inspection Category will be decided during evaluation
	Pressure / DP Switch (Other than Furnace Pressure Application)	II			Gauges Bourdon	Panvel	A			upto 40 Kg/cm2 & 200 C, not for compound switch application.
		II			Trafag	Ranipet	A			upto 40 Kg/cm2 & 200 C, not for compound switch application.
87	Printer	III			BHEL Approved Sources (Compatible with DDCMIS)		Noted			
88	Purge Meter	III			BHEL System		Noted			
89	Root valve for non pressure parts, airlock valve, Spare components etc	III			BHEL System		Noted			
90	Rotameter	III			Eureka	Pune	A			
		III			Scientific Instruments	Mumbai	A			

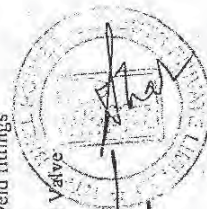
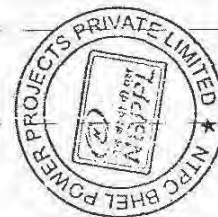
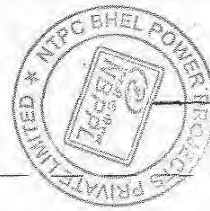


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01202

SR NO	ITEM	QP /INS- NO. -PN CAT	QP NO. 1450-001-9	QP SUB- QP MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
90	Rotameter	III			EPL	Hyderabad	A			
91	Sight Flow Indicators	III			Trac	Hyderabad	A			
92	Smart Positioner	III			Placka	Chennai	A			
		III			BHEL System		Noted			
		*			Smart	USA / Brazil	Noted			
		*			ABB	Germany	Noted			* To be covered in Control Valve QP
		*			Masolenien	France	Noted			* To be covered in Control Valve QP
		*			Fisher Rosemount	USA	Noted			* To be covered in Control Valve QP
		*			Dressor	USA	Noted			* To be covered in Control Valve QP
		*			Yokogawa	Japan	Noted			* To be covered in Control Valve QP
		*			Siemens	Germany	Noted			* To be covered in Control Valve QP
93	Socket & Plug, Pneumatic Fittings & Tubes, Flexible Hoses	III			BHEL System		Noted			
94	Socket weld fittings	III			BHEL Approved Sources		Noted			
95	Solenoid Valve	III			Rotex Automation Ltd	V V Nagar / Baroda	A			
		III			Jefferson	Argentina/ USA	A			
		III			ASCO	USA / India / UK	A			
		III			Heron	Germany / Italy	A			
96	Soot Blower Flow Switch	III			Barton Instrument System	USA	A			



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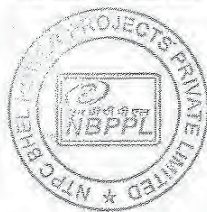
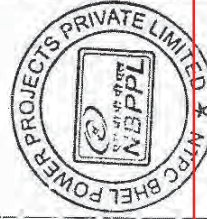
SR NO	ITEM	QP /INS- NO. CAT *	QP NO. 1450-001-9	QP SUB- QP MISSION /APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
97	Starter Box (Furnace Temperature Probe)	III			BHEL System		Noted			
98	Temperature Gauge (Dial Type MIS / Gas Filled Thermometer)	III			Budenberg	UK	A			
99	Temperature Gauge (Dial Type MIS Thermometer)	III			Dressor (Ashcroft)	USA / Germany	A			
		III			Nievo Fima	Italy	A			
		III			H Guru Instruments (South India Pvt Ltd)	Bangalore	A			
		III			Goa Thermostatic	Goa	A			
		III			GIC	Mumbai / Goa	A			
		III			A N Instruments	Narendrapur	A			
		III			Bells Controls	Kolkata	A			
		III			Dwyer	USA	A			
		III			Ashcroft (Dressor)	USA/ USA	A			
		II	QVI-Q-043		Switzer	Chennai	A			Up to 200 Deg. C
		II			Indfos	Chaziabad	A			Up to 200 Deg. C
		III			ITT Barton	USA	A			
101	Temperature Transmitter	II	QVI-Q-044		Yokogawa	Japan	DR			
		II			Endress and Houser	Germany	DR			
		II			Pepperl and Fuchs	Germany	DR			
		II			ABB	Germany	DR			
		II			Emerson process Mgt.	USA / Daman	DR			
		II			Honeywell	USA	DR			
102	Thermocouples & RTD	II	QVI-Q-045		Detriv Instrumentation & Electronics Ltd.	Mumbai	A			
149		II			Temsons	Udaipur	A			

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SR NO	ITEM	QP /INS-NO. /PN CAT	QP NO.	QP SUB-MISSION SCHEDULE	PROPOSED SUB-SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDULE	SC APPL SCHEDULE	REMARKS
102	Thermocouples & RTD	II	QVI-Q-045		GIC	Mumbai / Goa	A			
		II			Pyro Electric	Goa	A			
		II			Thermo Electric	Netherland	A			
		II			Degussa	Germany	A			
		II			BICC	UK	A			
		II			ISA Controls	UK	A			
		II			Pyro System Pvt Ltd	Chennai	DR			
103	Transducer	II	QVI-Q-046		AE	Mumbai	A			
		II			Rishab	Nasik	A			
		III			Metrawatt	Germany	A			
		II	QVI-Q-046		Elester	Mumbai	A			
		II			Southern Transducer	Chennai	A			
		III			Canille Bauer	Switzerland	A			
		III			Hirel		Noted			
		III			APC		Noted			
		III			IDB Power		Noted			
		III			Aplab		Noted			
		III			Emerson (Tata Libert)		Noted			
104	Vacuum Circuit Breaker	I	QVI-Q-047		Siemens	Germany / India	A			
		I			BHEL	Bhopal	A			
		II	QVI-Q-048		Excel Hydro	Mumbai	A			
		III			Schneider	Germany	A			
		III			Anderson Greenwood	USA	A			
		II	QVI-Q-048		Baldota	Mumbai	A			



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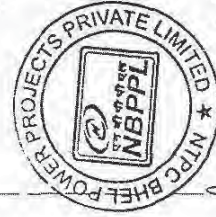
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SR NO	ITEM	QP /INS- NO. -PN CAT	QP NO. 1450-001-9	QIP SUB-QP MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHED ULE	SC APPL SCHED ULE	REMARKS
106	Valve Manifolds	II	QV1-Q-048		Aslec	Mumbai	A			
107	VFD Transformer	II			Hydair		DR			
107	VFD Transformer	I	QV1-Q-049		EMCO	Thane / Jalgaon	A			
		I			Voltamp	Vadodara	A			
		I			CGL	Malanpur	A			
		I			BHEL	Jhansi	A			
		I			Bharat Bijli	Mumbai	A			
		I			Kanchhar	Meerut	A			
		I			Areva	Naini/Vadodara	A			
		I			Transformer and Rectifier	Ahmedabad	A			
		I			TESLA	Bhopal	A			
		III			GEC	UK	A			
		III			Yokogawa	Japan	A			
		III			BHEL System		Noted			
108	Watt hour meters	II	QV1-Q-018							
109	Wire Markers, Clamps & Pads for thermocouple, Adaptor, Union, Cross	III			Reynolds Hi Tech	UK	NOTED			
110	Cable Trays	III			BHEL	Trichy	A			
111	Flexible coupling for VFD	III			EIP Enviro	Noida	A			
112	Flame scanner Amplifier	II	QV1-Q-019		Nivo Controls	Indore	A			
113	Ash level Switches	III			BHEL System		NOTED			
114	LGM Box, Pneumatic Tubes, Flexible Hoses, Miniature JB,	III			BHEL System		NOTED			
115	Calibration probes and cable for Gravimetric feeder calibration	III			BHEL System		NOTED			

REFER LIST 1450-001-QOE-R44



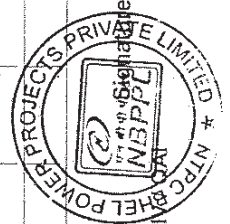
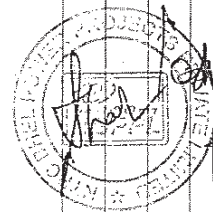
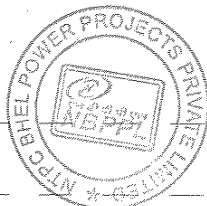
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SR NO	ITEM	QP /INS-NO. /PN CAT	QP SUB- QP MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
41	Intelligent Battery Charger 24 V dc, DCDB & BHMS	I		Eltek SGS Pvt Ltd	Gurgaon	A			
		I		Mastek	Mumbai	A			Modules from Eltek
		I		Chhabhi Electricals	Jalgaon	A			Modules from Emerson
42	Isolator			Stahl	Brand Name	Noted			Will be covered in DDCMIS QP
				Wied Muller	Germany	Noted			Will be covered in DDCMIS QP
				MTL	Brand Name	Noted			Will be covered in DDCMIS QP
				Turck	Brand Name	Noted			Will be covered in DDCMIS QP
				P & F	Brand Name	Noted			Will be covered in DDCMIS QP
43	Level Transmitter (Radar Type)	III		Emerson (Stab Rosemount)	Sweden	A			
		III		E&H	Germany / Aurangabad	A			
		III		K Tek (ABB)	USA	A			
		III		Emerson	Daman	A			
		III		Magnetrol	Belgium	A			
		*		Siemens	Germany	DR			*Inspection Category will be decided during evaluation.
44	LIE / LIR / Gauge Board / Metallic JB	I		Saajas Electricals	Tricity	A			
		I		Chemin	Pondichery	A			
		I		Pranmen Industries	Pudikottai	A			
		I		Instrumentation Ltd	Kota	A			
		I		Pyrotech	Udaipur	A			



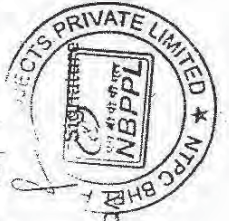
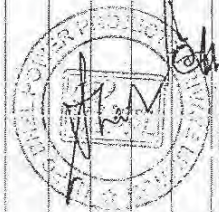
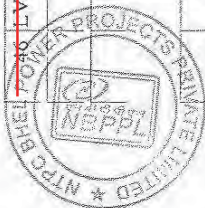
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SR NO	ITEM	QP INS- PN CAT	QP NO. 1450-001- CAT	QP SUB-QP MISSION APPL SCHEDULE	PROPOSED SUB SUPPLIER	PLACE	APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
44	LIE / LIR / Gauge Board / Metallic JB	I I			Marisha Enterprises FORBES MARSHALL PUNE	Pune	DR DR	Attadon		
45	Lugs	III			Amp	USA	A			
		III			Dowells	Mumbai	A			
		III			Christie	USA	DR			Refer Note 5
		III			Barco	Germany	DR			Refer Note 5
		III			Planar Systems	USA	DR			Refer Note 5 (Earlier Syntec, France & Clarity, USA)
		III			Ryevis	Germany	DR			Refer Note 5
		III			Delta SHARP	China JAPAN	DR DR	Attadon		Refer Note 5
47	Master Slave Clock System	II			Hathway	USA	A			
		II			Hopf Baker Sertel Massey Mein Berg	Germany GERMANY GERMANY GERMANY Germany	A DR A DR DR	Attadon		
48	Mosaic Tiles / Console Items	III			Tew	Germany	A			Earlier Subklew
49	Network Components	III			Pro-Plan	Germany	A			Earlier Boyko Strey
		III			Foundary		Noted			
		III			Avaya	USA	Noted			
		III			Cisco		Noted			
		III			Netgear		Noted			
		III			Garret	USA	Noted			
		III			Hirschmann	Germany	Noted			
		III			Enterasys	USA	Noted			
		III			HP (3 Com, H3C)		Noted			



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USA: DR Attadon

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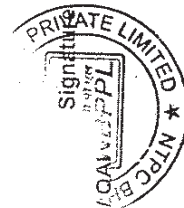
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APPENDIX-E (MOM-QA)

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SR NO	ITEM	QP /INS- NO. CAT *	QP SUB- MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
32	Flue Gas Analyser (O2 Analyser (LT))	III		Enotec GmbH	Germany	A			Model Oxitec 3000 series
33	Flue Gas Analyser Panel	III		Fuji Electric	Japan	DR			
		I		ABH	Bangalore	A			
		I		Pyrotech	Udaipur	A			
		I		Chemtrol	Goa	A			
		I		Emerson Process Management	Daman	A			
34	PR Junction Box	I		Yokogawa	Bangalore	DR			
		III		Suchitra Industries	Bangalore	Noted			
		III		K. S Instruments	Bangalore	Noted			
		III		Manisha Enterprises	Pune	Noted			
		III		Hensel	Chennai	Noted			
		III		Baliga Lighting	Chennai	Noted			
		III		Devi Polymer	Chennai	Noted			
35	Graphic Interface Unit	III		Digital Instruments and Control System (Proface)	Bangalore	A			Proface Brand
		III		Schnieder Electric		A			
		III		Rockwell Automation		A			
		*		Siemens	Germany	DR			* Inspection Category will be decided during evaluation.
36	Hand Held Calibrator	III		Main Contractor Approved Sources		Noted			Compatible with the Transmitter to be Supplied & Subject to meeting NTPC specification requirement



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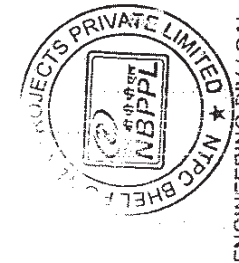
01240

Package: EPC PACKAGE			LIST OF ITEMS REQUIRING QUALITY PLAN SUBCONTRACTOR APPROVAL			Revision No: 00				
CONTRACTOR: BHEL			SUB SYSTEM: Control panels & Control Desk			Date:				
CONT NO: CS-1450-001-9			SUB SYSTEM: Control panels & Control Desk			Date:				
SR NO	ITEM	QP /INS- PN CAT *	QP NO. 1450-001	QP SUB- QP MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
1	Control Desk/Control panel(PLC/Mosaic type)	I 215			Positronics	baroda	A			
		I			Pyrotech	Udaipur	A			
		I			IL	Kota	A			
		I			Siemens	Mumbai	A			
2	Control Panel(Non PLC/Non Mosaic type)	I 216			Positronics	Baroda	A			
		I			Pyrotech	Udaipur	A			
		I			Elecmec	Ahmedabad	A			
		I			Controls & Switchgear	Noida	A			
		I			ISC	Mumbai	A			
		I			Sajas Electricals	Trichy	A			
		I			Prammen Industries	Pudukattai	A			
		I			Industrial Control Appliances	Mumbai	A			
		I			Chemin Control	Pondicheery	DR			
		I			Vevee Control	Bangalore	DR			
		I			Asba Industries	Trichy	DR			
		I			Inochem Industries	Mumbai	DR			

1. BHEL will forward sub vendor details of maximum 3 subvendors against sub vendors identified under DR category for the item at sr. no 2.

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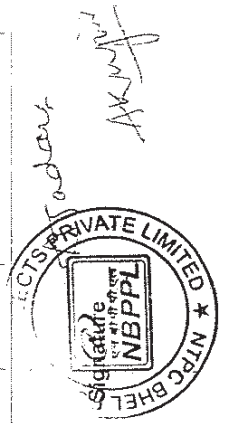
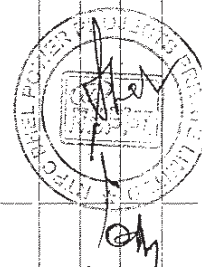
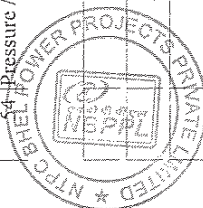


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SR NO	ITEM	QP /INS- PN CAT *	QP NO. 1450-001-	QP SUB- MISSION APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
54	Pressure / D P / Flow Transmitters	II			Yokogawa	Japan	A			Calibration at M/s YIL Bangalore is also acceptable
		I			Emerson process mgt.	Daman	A			
		II			Fuji Electric	Japan	A			
		*			Siemens	Germany	DR			* Inspection Category will be decided during evaluation.
55	Printer (Dot Matrix)	III			Foxboro	USA	DR			
56	Printer (Inkjet)	III			Lipi / Wipro / TVSE / Genicom / IBM / Epson / Lexmark		A			
57	Printer (Laser)	III			HP / Canon / Epson / IBM / Lexmark		A			
58	Semaphore Indicators	III			ABB	Germany	A			
		III			K & N	Austria	A			
		III			Subklew	Germany	A			
		III			Siemens	Germany	A			
59	Socket weld fittings	III			Metpress	Kolkata	Noted			
		III			Baldota	Mumbai	Noted			
		III			Excell Hydro	Mumbai	Noted			
		III			Flow Tech	Kolkata	Noted			
		III			V K Industry	Bangalore	Noted			
		III			H P Valves & Fittings	Chennai	Noted			
		III			Aura Inc	Delhi	Noted			
		III			Precision	Mumbai	Noted			
		III			Vikas	Delhi	Noted			



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SR NO	ITEM	QP /INS- PN CAT	QP NO. 1450-001-9	QP SUB- MISSION SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB- SCHED ULE	SC APPL SCHED ULE	REMARKS
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1. A - Proposed vendor is acceptable to NTPC, DR - "Details Required" for NTPC records updation only., NOTED - For these items vendors are proposed by main supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with "NOTED"

2 QP/INSPECTION CATEGORY

CAT - I : For those items the Quality Plans are approved by NTPC and final acceptance will be on physical inspection witness by NTPC
CAT - II : For those items the Quality Plans are approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis of review of documents as per QP.

CAT - III : For those items Main supplier approves Quality Plan. The final acceptance by NTPC shall on the basis of Certificate of Conformance by main supplier.

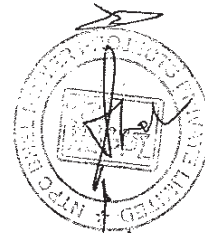
NOTE 1 : Galvanising of cable trays ,junction boxes shall be done at NTPC approved sources viz. KANADE ANAND UDYOG-MUMBAI, MJ Engg-New Delhi, Visakha steel allieds-Ankapalli, Karamtara-Thane, Unistar-Kolkata, B. J Shirke-Pune, Jamna metals Delhi ,Galfan Engrs Chemical, Poona galvanisers-Poona,M/s Sigma Galvanisers Mumbai, Gurpreet-Hydrabad.

NOTE 2 : a) Acceptance of Motor less than 30 KW is based on COC of the manufacturer and the contractor confirming as follows: It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage and frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud and gland plate and tested in accordance with approved drawing /data sheets upto 50 KW

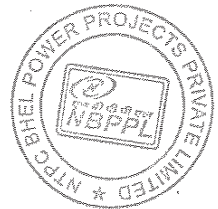
b) 30 KW and above Acceptance of Motor rating between 30 KW/50 KW is based on NTPC review of Routine Test inspection report as per IS 325 witnessed by main contractor along with COC of the manufacturer and the contractor confirming as follows: It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage and frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud and gland plate, space heater and tested in accordance with approved drawing /data sheets.Above 50 KW up to 200 KW NTPC INSPECTION AS PER NTPC APPROVED QP

NOTE 3 : For HT Motors refer List no. 1450-001-QOE-R-014 R 00 NOTE 4 : LT Cables against subject package shall be procured from single source only.

NOTE 5: Any C I sub supplier approved for any previous/ ongoing project / package is approved for other project / package unless and until clearly indicated in the approval letter.



Signature
NTPC



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Signature

ENGINEERING DIV / QAI



TITLE:

**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM****1X500MW UNCHAHAR TPP,STAGE-IV**

BHEL DOCUMENTS NO.: PE-TS-401-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE: 20/07/2014

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**ANNEXURE – V
PAINTING SCHEDULE**

Client : LOI/Order Ref. No. : Project :						Job No. : BHEL Doc. Ref. No. :								
PAINTING SCHEDULE														
Sl. No.	Equipments	Surface Preparation	Primer Coat			Intermediate coat			Finish Coat			Total DFT (Micron)	Colour Shade	Remarks
			Type	No of coats	DFT per coat (Micron)	Type	No of coats	DFT per coat (Micron)	Type	No of coats	DFTper coat (Micron)			
I	Self Manufactured (Fabricated Items)													
A)	Denseveyor ,Pyrite Hopper	Deagreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	Heat resistant aluminium paint	2	20	~	~	~	Heat resistant aluminium paint	2	20	~ 80		
B)	Air Receiver, Bunker Discharge Gate , Pressure Relief Valve, Terminal Box.	Deagreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	HB Zinc Phosphate (Alkyd medium)	2	35-45	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	2	20-25	~ 110-140	Ref. Annexure-I enclosed	
C1)	Pneumatic Panel for Denseveyor	Seven Tank Process	HB Zinc Phosphate (Alkyd medium)	2	35-45	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	2	20-25	~ 110-145	Ref. Annexure-I enclosed	
C2)	Compressor Panel, Main Control Panel	Seven Tank Process	HB Zinc Phosphate (Alkyd medium)	2	35-45	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	2	20-25	~ 110-145	Ref. Annexure-I enclosed	
II	Bought Out Items													
1	Conveying air compressor, Motors	Deagreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	HB Zinc Phosphate (Alkyd medium)	2	35-45	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	2	20-25	~ 110-140	Ref. Annexure-I enclosed	
2	Plate Valves (Cylinder Optd. & Hand Wheel Optd.) , Metallic Expansion Bellow .	Deagreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	Heat resistant aluminium paint	2	20	~	~	~	Heat resistant aluminium paint	2	20	~ 80		
3	C.I valves , Rupture Disc , Chain Pulley Block & Bag Filter Casing	Deagreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	Red Oxide Zinc Chromate as per IS:2074 (Alkyd medium)	2	25-35	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	3	20-25	~ 110-145	Ref. Annexure-I enclosed	
4	Structural Steel works including mill rejects storage bunker	SA 2 1/2	Inorganic Zinc Silicate Primer	1	75	Epoxy based Titanium di-oxide	1	75	Epoxy based two pack finish paint Final coat of PU paint	2 1	35 30	~ 250	Ref. Annexure-I enclosed	Site Painting Work
5	Compressed air piping, Mill Rejects conveying piping, cooling water piping, service water piping, pipe fittings and ACI Bends.	Deagreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	Red Oxide Zinc Chromate as per IS:2074 (Alkyd medium)	2	25-35	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	3	20-25	~ 110-145	Ref. Annexure-I enclosed	Site Painting Work

Notes:

- 1 Surface preparation shown is as per Swedish standard SIS 05-5900.Degreasing will be as per Standard SSPC-SP1
- 2 GM / SS Valves and Galvanised Instrument Air Pipes will not be painted.
- 3 All instruments shall be painted as per manufacturer standard practice.
- 4 Method of painting application shall be as per paint manufacturer's recommendation.
- 5 Colour coding will be as per NTPC document no:QS-01-DIV-W-04 , Rev-1
- 6 Item/Material as per s.no 4 & 5 shall be painted at site.

ANNEXURE - A								
COLOUR AND CODING SCHEME								
Sl. No.	Equipment Description	Ground Colour		Identification Tag/Band			Legend	Remarks
		Colour	RAL	Colour	ISC No.	Equivalent RAL No.		
1	Air Receiver	Blue	5012	White		9010		
2	Motor	Blue	5012					Enamel Paint to be used
3	Pneumatic panel for Denseveyor	Blue & Grey	5012 9002					Front & Rear panels in Grey.End Panels sides in Blue
4	Conveying Air Compressor/After Cooler	Blue	5012	White		9010		Identifying legends to be used
5	Compressor panel, main control panel	Grey	9002					
6	Rupture Disc,Bag filter casing ,Bunker Discharge gate, Pressure Relief Valve, Terminal box	Grey	9002					
7	Structural steel works including mill rejects storage bunker	Blue & Grey	5012 9002					Primary strl members(columns & beams) in Blue Secondary members in Grey
8	Compressed air piping, Valves & Fittings.	Grey	9002	Sky Blue	101		PA	
9	Mill rejects convey piping valves & fittings, ACI Bends	Grey	9002	White		9010		
10	Service water lines, valves & fittings	Grey	9002	Sea Green	217		RW/ SW	
11	DMCW water lines, valves & fittings	Grey	9002	Sea Green	217		DMW	
12	Chain Pulley Block with Monorail	Golden Yellow	1004					
13	Hook	Signal Red	3001					



TITLE:

**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM****1X500MW UNCHAHAR TPP,STAGE-IV**

BHEL DOCUMENTS NO.: PE-TS-401-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

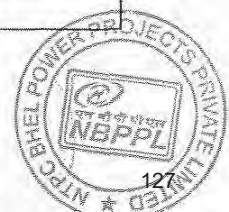
DATE: 20/07/2014

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ANNEXURE – VI**LOW PRESSURE PIPING SPECIFICATION**

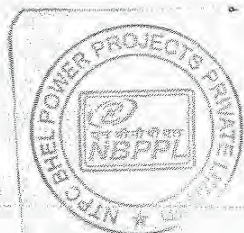
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC																																					
	LOW PRESSURE PIPING 1.00.00 EQUIPMENT SIZING CRITERIA 1.01.00 All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period. 1.02.00 For all L.P. piping system covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated elsewhere. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration. 1.03.00 Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following: a) Water Application <table><thead><tr><th></th><th>Pipe Size</th><th colspan="3">Water Velocity in m/sec</th></tr><tr><th></th><th></th><th>Below 50 mm</th><th>50-150 mm</th><th>200 mm & above</th></tr></thead><tbody><tr><td>(a)</td><td>Pump suction</td><td>-----</td><td>1.2-1.5</td><td>1.2-1.8</td></tr><tr><td>(b)</td><td>Pump discharge and recirculation</td><td>1.2-1.8</td><td>1.8-2.4</td><td>2.1-2.5</td></tr><tr><td>(c)</td><td>Header</td><td>-----</td><td>1.5-2.4</td><td>2.1-2.4</td></tr></tbody></table> Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec. WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value: <table><tbody><tr><td>(i)</td><td>Carbon steel pipe</td><td>100</td></tr><tr><td>(ii)</td><td>C.I Pipe/ Ductile Iron.</td><td>100</td></tr><tr><td>(iii)</td><td>Rubber lined steel pipe</td><td>120</td></tr><tr><td>(iv)</td><td>Stainless steel pipe</td><td>100</td></tr></tbody></table>		Pipe Size	Water Velocity in m/sec					Below 50 mm	50-150 mm	200 mm & above	(a)	Pump suction	-----	1.2-1.5	1.2-1.8	(b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5	(c)	Header	-----	1.5-2.4	2.1-2.4	(i)	Carbon steel pipe	100	(ii)	C.I Pipe/ Ductile Iron.	100	(iii)	Rubber lined steel pipe	120	(iv)	Stainless steel pipe	100	
	Pipe Size	Water Velocity in m/sec																																					
		Below 50 mm	50-150 mm	200 mm & above																																			
(a)	Pump suction	-----	1.2-1.5	1.2-1.8																																			
(b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5																																			
(c)	Header	-----	1.5-2.4	2.1-2.4																																			
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(iii)	Rubber lined steel pipe	120																																					
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SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING	PAGE 1 OF 30																																				



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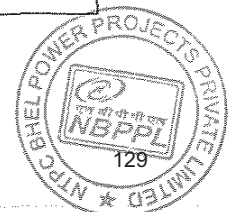
CLAUSE NO.	TECHNICAL REQUIREMENTS	NTPC																													
	For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/ sump/ reservoir from which the pumps draw water. (b) Compressed Air Application Compressed air 6.0 m/sec.(under Average Pressure & Temp. conditions)																														
1.04.00	The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.																														
1.05.00	Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.																														
1.06.00	Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered.																														
1.07.00	Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.																														
1.08.00	All high points in piping system shall be provided with vents along with valves. All low points shall be provided with drains along with valves. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.																														
1.09.00	Material of construction for pipes carrying various fluids shall be as specified elsewhere.																														
1.10.00	Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.																														
1.11.00	Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.																														
1.12.00	Threaded joints shall be provided with Teflon sealant tapes.																														
1.13.00	Following types of valves shall be used for the system/service indicated.																														
<table><tr><th>SYSTEM</th><th colspan="6">TYPES OF VALVES</th></tr><tr><th></th><th>Butterfly</th><th>Gate</th><th>Globe</th><th>Check</th><th>Ball</th><th>Plug</th></tr><tr><td>Water</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr><tr><td>Air</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr></table>		SYSTEM	TYPES OF VALVES							Butterfly	Gate	Globe	Check	Ball	Plug	Water	x	x	x	x	x		Air		x	x	x	x			
SYSTEM	TYPES OF VALVES																														
	Butterfly	Gate	Globe	Check	Ball	Plug																									
Water	x	x	x	x	x																										
Air		x	x	x	x																										
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B		SUB-SECTION-A-07 LOW PRESSURE PIPING		PAGE 2 OF 30																									



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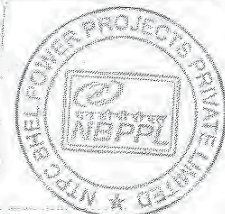
4/8/2019

CLAUSE NO.	TECHNICAL REQUIREMENTS						
	Drains & vents		X		X		X
	Fuel oil (if any)	X		X		X	X
1.14.00	Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (p&ids). The recirculation pipe shall be sized for minimum 30% design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.						
2.00.00	TECHNICAL SPECIFICATION						
2.01.00	GENERAL						
	Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers / supports, tanks etc.						
2.02.00	Pipes and fittings						
2.02.01	All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.						
2.02.02	Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.						
2.02.03	Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.						
2.02.04	Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).						
2.02.05	Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the						
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B			SUB-SECTION-A-07 LOW PRESSURE PIPING		PAGE 3 OF 30



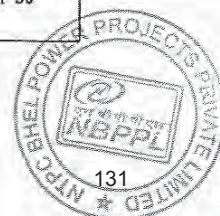
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.		
2.02.06	The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/ expansion joint etc. shall be provided as may be necessary depending on layout.		
2.02.07	Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.		
2.02.08	For rubber lined ERW pipes, beads shall be removed.		
2.02.09	Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes.		
2.02.10	At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.		
2.02.11	For large size pipes/ducts, at high point and bends/change of direction of flow, air release valves shall be provided. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code. Transient analysis /surge analysis where ever specified and required shall be conducted in order to determine the location , number and size of the Air-Release valve on certain long distance/high volume piping systems, if applicable within the scope of work of the package.		
2.03.00	Material		
2.03.01	Alternate materials offered by Bidder against those specified. shall either be equal to or superior to those specified. The responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.		
2.03.02	No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.		
2.03.03	All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockists are not acceptable.		
2.03.04	All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable references to enable identification of the certificate that certifies the material.		
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING PAGE 4 OF 30



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CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.03.05	Material of construction for pipes carrying various fluids shall be as follows:			
	1	Raw water, ash water, circulating Water, aux. cooling water, clarified Water, service water, air pre-heater Wash water, clarifier sludge and Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain water	IS-2062Gr.B/ASTMA36/ASTM A-53 type 'E' Gr.B / IS-3589 Gr. 410 /IS-1239 Heavy. For equipment cooling water system wherever DM water is used or alkaline solution is used for pipes 50NB and below, pipe material shall be stainless steel to ASTM A312 Gr. 304 sch. 40 Seamless.	
	2	Demineralised water, (condenser Make up water, Boiler fill and Deaerator Fill water, equipment cooling Water piping from overhead tank to Suction header of DMCW and chemical dosing system to Primary circuit of equipment Cooling water (DMCW System), ECW overhead tank make-up water	Stainless steel to ASTM A-312, Gr.304 welded for sizes above 50mm NB Stainless steel to ASTM A312, Gr. 304 sch. 40 Seamless for sizes 50mm and below	
	3	Drinking water galvanized/ IS 1239 heavy	ASTM A-53 type E Gr. B galvanized/IS 3589 Gr 410 Galvanized to IS- 4736 or equivalent.	
	4.	Instrument air & plant air. galvanized/ IS 1239 heavy galvanized to IS- 4736 or	ASTM A-53 type E Gr. B galvanized/IS 3589 Gr 410 equivalent.	
	5.	(Condensate) spill water/ Deaerator Drain	ASTM A 106 Gr. B	
	6.	Oil piping	API 5L	
2.03.06	In water lines, pipes upto 150mm Nb shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr.B /IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS:1239 Grade Heavy except for demineralised water, drinking water and condensate spill lines.			
2.03.07	Pipes of above 150mm Nb shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr.B/ASTM-A-36. However, larger pipes, i.e. 1000mm Nb and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr.B and shall meet the requirements of AWWA-M-11 (for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).			
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING	PAGE 5 OF 30

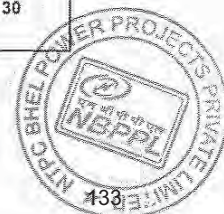


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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
2.03.08	In demineralised water service, the pipes upto 50 Nb shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65mm NB upto and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness. Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.		
2.03.09	Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410 / IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B / IS: 3589, Gr. 410 / IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).		
2.03.10	Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.		
2.03.11	Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.		
2.03.12	If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.		
2.04.00	Piping layout		
2.04.01	Piping shall be grouped together where practicable and routed to present a neat appearance.		
2.04.02	Piping routing shall be such as to provide sufficient clearance for removal and maintenance of -equipment, easy access to valves, instruments and other accessories. The piping shall not encroach on the withdrawal space of various equipments.		
2.04.03	Over head piping shall have a normal minimum vertical clearance of 2.5 meters above walkways and working areas and 8m above roadways/railways. When several pipe lines are laid parallel, flanged joints must be staggered. Welded and flanged joints should as far as possible be located at one third span from supports. If the support is situated right under the welded joints this joint must be reinforced with a strap. Flanged and welded joints must be avoided in the middle of the span. Valves should be located in such a manner so as to ensure their convenient operation from the floor or the nearest platform.		
2.04.04	Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare		
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING PAGE 6 OF 30

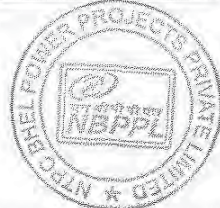


CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.			
2.04.05	All piping shall be routed so as to avoid interference with other pipes and their hangers and supports, electrical cable trays, ventilation ducting, structural members, equipment etc. Adequate clearance shall be ensured with respect to the above to accommodate insulation and pipe movements, if any.			
2.04.06	Piping shall generally be routed above ground but where specifically indicated/approved by the Project Manager the pipes may be arranged in trenches or buried. Pipes at working temperature above the ambient shall however not be buried.			
2.04.07	Sufficient up stream and down stream lengths shall be provided for flow measuring devices, control valves and other specialties.			
2.04.08	All local instruments shall be located on pipe lines as to render them observable from the nearest available platforms.			
2.04.09	Openings provided in the wall for pipelines must be closed with bricks and mortar with 10-12 mm clearance between brick work and pipe after taking care of insulation and thermal movement, if any. The clear space must be filled with felt or asbestos or approved filling compound.			
2.05.00	Slope/Drains and Vents			
2.05.01	Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. In addition to the system requirement all low points in the pipelines shall be provided with suitable draining arrangement and all high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes.			
2.05.02	Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.			
2.06.00	Pipe Joints In general all water lines 65mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.			
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING	PAGE 7 OF 30



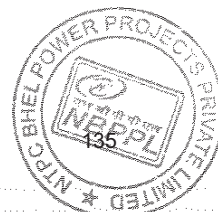
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
2.06.01	Screwed (a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/IS: 554 unless specified otherwise. (b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be joined by welding. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, along with the nascent threaded metal portions at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test. (c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately. (d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate paste. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing. (e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where galvanic protection has been impaired due		
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING	PAGE 8 OF 30



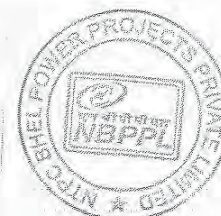
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
2.06.02	to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint. Welded (a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.	
2.06.03	Flanged (a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only. (b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification. (c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.	
2.07.00	Bends/elbows/mitre bends/ Tees/ Reducers & other fittings	
2.07.01	Unless otherwise specified elbows shall be of long radius type.	
2.07.02	For pipe sizes up to 65Nb, long radius forged elbows or seamless pipe bends shall be used. Pipe bends, if used, shall be cold bent to a radius measured to the centre line of pipe of 3 to 5 times the pipe diameter.	
2.07.03	For steel pipes 80 Nb and above, seamless long radius forged elbows shall be used. For pipe size 350Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.	
2.07.04	Mitre bends are not acceptable in case of rubber lined mild steel pipes.	
2.07.05	For pipe fittings such as reducers and tees, the material shall be to astm-a-234 gr. WPB up to 300 NB. For pipe reducers and tees above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI B-16.9. However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.	
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B SUB-SECTION-A-07 LOW PRESSURE PIPING PAGE 9 OF 30



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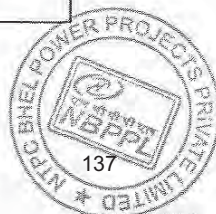
CLAUSE NO.	TECHNICAL REQUIREMENTS		
	For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.		
2.07.06	Stainless steel fittings shall conform to either ASTM-A-182, Gr. 304 (316 for Sea water application, if any) or ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any) Class-S, for sizes up to and including 50mm NB, i.e., the fitting shall be of seamless construction. However, for stainless steel fittings above 50mm NB, the same shall conform to ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any), Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.		
2.07.07	In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.		
2.08.00	Flanges		
2.08.01	Flanges shall be slip on type. Welding of flanges in tension is not permitted.,		
2.08.02	All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 (316 for Sea water application, if any) or equivalent.		
2.09.00	Specific technical requirement of laying buried pipe with anti corrosive treatment The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.		
2.09.01	Trenching (a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822. (b) Free access shall be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained. (c) The free working space shall conform to IS: 5822. The trench shall be excavated so as to provide minimum cover of 1000mm between the top of the pipe and finished grade. (d) Prior to lowering and laying pipe in any trench, the bidder shall backfill and compact the bottom of the trench or excavation in accordance with is: 5822 to provide an acceptable bed for placing the pipe. (e) Coating and Wrapping shall be done as under		
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING PAGE 10 OF 30



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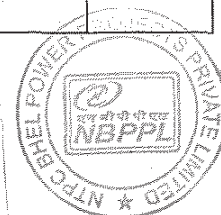
CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
2.09.02	Preparation and cleaning of piping (a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Kerosene will not be permitted for cleaning. This cleaning operation shall be immediately followed by priming with the mechanical priming machine. (b) Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager. (c) The cleaning and priming operation shall be carried out at site. The entire pipe length shall be cleaned but the ends of the pipes shall be left without coating for a distance of 230mm for joints, which shall be coated manually at site after laying, welding and testing the pipe. (d) On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.		
2.09.03	Coating and wrapping (a) Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are: (1) Coating primer (coal tar primer) (2) Coating enamel (coal tar enamel) (3) Wrapping materials. (b) All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable. (c) Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat (d) Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of. Coats and wraps shall be decided based on soil corrosivity/resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available. (e) Total thickness of completed coating shall not be less than 4.0 mm.		
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING	PAGE 11 OF 30



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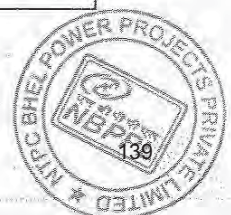
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
	(f) Alternatively, the anti-corrosive protection can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to AWWA-C-203. These-tapes shall be applied hot over the cold coal tar primer preferably in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total thickness of the finished protective coating shall be 4.0 mm minimum.	
2.09.04	Trench bed preparation and back filling Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an <i>acceptable bed</i> for placing the pipe. Bed preparation in general shall be as per IS: 5822.	
2.09.05	Laying of galvanized steel (GI) pipes All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be <i>thoroughly cleaned and painted with a mixture of red and white lead</i> before jointing Threaded portion on either side of the socket joint shall be applied with Zinc silicate paste. All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and " anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.	
2.10.00	Cleaning and flushing	
2.10.01	All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.	
2.10.02	Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done in such a manner that the coating on MS pipe is not affected.	
2.10.03	After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.	
2.10.04	All compressed air pipe work shall be cleaned by blowing compressed air.	
2.11.00	Surface preparation and painting Pipes shall be cleaned both internally and externally thoroughly by blast-cleaning or power tool cleaning method as indicated above.. In case of oil piping, cleaning will have to be done by pickling. No painting is required on galvanized pipe surface or galvanized steel surface. However, necessary color banding for identification as per color code shall be done. External surface of piping shall be cleaned and prepared as indicated below.	
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING
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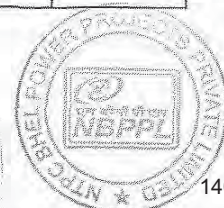
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
2.11.01	Primer painting (a) After the surface is prepared two coats of red oxide (zinc chromate/zinc phosphate) primer conforming to IS-2074/IS-12744 or equivalent shall be applied. Primer coat shall be immediately applied without any time lag after the surface preparation. (b) Any equipment which has been given the shop coat of primer shall be carefully examined after its erection in the field and shall be treated with a touch up coat of primer wherever the shop coat has been abraded, removed or damaged during transit/erection, or defaced during welding.			
2.11.02	Finish painting (a) Paint to be used shall be synthetic enamel paint conforming to IS-2932 or equivalent. Finish painting shall be carried out in three coats consisting of one intermediate coat and two finishing coats. Dry film thickness (DFT) of painting inclusive of primer thickness shall be at least 150 micron. (b) The primed surface shall be cleaned of dust/dirt/grease etc. without scratching or in any way damaging the primer coat. The intermediate coat shall be allowed to dry before applying the finish coat or as recommended by paint manufacturer. (c) Paint shall be applied by brushing. It shall be ensured that brush marks are a minimum and the requirements of workmanship is as specified in IS-1477. (d) Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of the ready mix type in original sealed containers as packed by the paint manufacturer. No thinners shall be permitted. (e) No painting shall be done in frost/foggy weather or when the humidity is high to cause-condensation on the surface to be painted. (f) The dry film thickness (DFT) after the painting shall not be less than 150 microns.			
2.11.03	Other requirements (a) Paint manufacturers instructions shall be followed in method of application, handling, drying time etc. (b) The color of the finish paint shall be as per approved color-coding. (c) If finish paint was applied in shop, one coat of finish paint shall be applied at site. (d) The dry film thickness of paint shall not be less than 0.15 mm.			
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING	PAGE 13 OF 30



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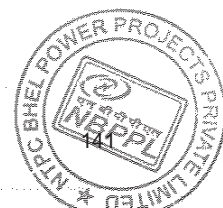
CLAUSE NO.	TECHNICAL REQUIREMENTS	नवीपीसी NTPC
2.11.04	Color code for identification	
	The pipes shall be color painted/banded for identification as per the approved color-coding scheme and shall be generally as per IS-9404.	
2.12.00	Specification for hangers and supports	
2.12.01	All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.	
2.12.02	While designing supports for rubber lined pipes special consideration should be given. Any kind of welding on these pipes is not allowed after rubber lining.	
2.12.03	Hanger for piping 65mm Nb and larger and all spring support assemblies regardless of size shall be completely engineered in conformance with the provisions of power piping code ANSI B 31.1.	
2.12.04	Hangers, saddles, supports etc. shall be fabricated from plates/pipes sections conforming to ASTM A 53/IS: 2062/IS: 226/or equivalent. They shall be designed to provide the required supporting effects and allow pipe line movements as necessary. The structural steel work shall be as per IS: 800/BS: 4360. Insulation protection saddles shall be used at support point of all insulated piping.	
2.12.05	The support shall be so interspaced as to minimize sagging of the pipes and to keep them within permissible limits where pipes are full with the conveying media.	
2.12.06	The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.	
2.12.07	All pipe supports shall be designed to provide an absolute minimum head room of 2.5 m from floor in passages/walkways.	
2.12.08	At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.	
2.12.09	All components of hangers/supports shall be provided with two coats of primer (red oxide paint) at shop before dispatch to site. After erection they shall be given finish coat of Long Oil Synthetic enamel to IS: 2932 of total DFT 100 to 140 microns. CLH & VLH will be primed with Epoxy Zinc rich primer of 50 micron followed by finish painting of Aliphatic Acrylic Polyurethane or equivalent of DFT 65 microns.	
2.13.00	Design/Construction/Material Particulars of Gate/ Globe/Check Valves/ Globe Stop Valve/Butterfly valve	
2.13.01	GENERAL (a) All valves shall be suitable for the service conditions i.e flow, temperature and pressure, at which they are required to operate.	
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B SUB-SECTION-A-07 LOW PRESSURE PIPING PAGE 14 OF 30



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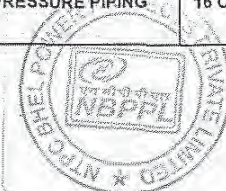
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	(b) The valves as well as all accessories shall be designed for easy disassembly and maintenance. (c) Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion. (d) All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be of outside screw and yoke type. (e) All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced. (f) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined. (g) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. For valves of size 350mm and above either bevel or spur gearing shall be provided to facilitate manual operation. (h) The valves coming in vacuum lines shall be of extended gland type and/or water sealed. (i) The actuator-operated valves shall be designed on the basis of the following: (1) The internal parts shall be suitable to support the pressure caused by the actuators; (2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc. (3) All actuator-operated valves shall be provided with hand operated gearing mechanism also. (4) All actuators operated valves shall open/ close fully within time required by the process. (j) Valves coming under the purview of IBR shall meet IBR requirements. (k) Gate/sluice valves shall be used for isolation of flow. Gate valves shall be provided with the following accessories in addition to other standard items: (1) Hand wheel (2) Position indicator (for above 50 mm NB valve size)		
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING	PAGE 15 OF 30



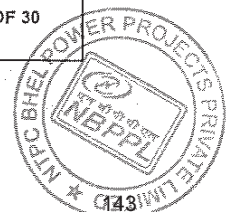
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
	(3) Bypass valves and gear operators for valves of size 350 NB & above. (3) Draining arrangement wherever required. (l) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction. (m) Check valves shall be used for non-return service. They shall be swing check type or double door (Dual plate) check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening /closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600mm NB (n) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing. (o) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable. (p) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc. (q) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer. (r) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore. (s) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.	
SINGRAULI STPP STAGE-III (1X500 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION - VI PART-B	SUB-SECTION-A-07 LOW PRESSURE PIPING PAGE 16 OF 30



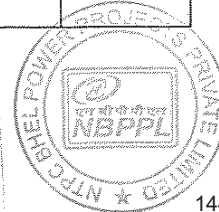
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC																			
2.13.02	VALVE BODY MATERIAL Valve body material for various services shall be as follows: Valve body material for water application like circulating water, Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) & drinking water shall be cast iron for sizes 65NB and above; gun-metal for sizes 50 Nb and below. For compressed air application, valve material shall be galvanized cast carbon steel or galvanized forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below. DM water: SS body and disc along with SS internals. Condensate: Cast Carbon Steel / Forged Carbon Steel.																					
2.13.03	The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards. Standards and Codes <table><tr><td>AWWA-C-504</td><td>Rubber seated butterfly valves.</td></tr><tr><td>BS-5155/EN-593</td><td>Cast iron and carbon steel butterfly valves for general purpose.</td></tr><tr><td>IS-778</td><td>Gun-metal gate, globe and check valves for general purpose.</td></tr><tr><td>BS-5154</td><td>Copper alloy globe/globe stop and check and gate valves for general purpose.</td></tr><tr><td>IS-780</td><td>Sluice valves for water works purpose (50-300 mm size)</td></tr><tr><td>IS-2906</td><td>Sluice valves for water works purpose (350-1200 mm size)</td></tr><tr><td>IS-5150</td><td>Cast iron wedge and double disc gate for general purpose.</td></tr><tr><td>BS-5152</td><td>Specification for cast iron globe valves.</td></tr><tr><td>BS-5153</td><td>Cast iron check valves for general purpose.</td></tr></table>				AWWA-C-504	Rubber seated butterfly valves.	BS-5155/EN-593	Cast iron and carbon steel butterfly valves for general purpose.	IS-778	Gun-metal gate, globe and check valves for general purpose.	BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.	IS-780	Sluice valves for water works purpose (50-300 mm size)	IS-2906	Sluice valves for water works purpose (350-1200 mm size)	IS-5150	Cast iron wedge and double disc gate for general purpose.	BS-5152	Specification for cast iron globe valves.	BS-5153	Cast iron check valves for general purpose.
AWWA-C-504	Rubber seated butterfly valves.																					
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IS-780	Sluice valves for water works purpose (50-300 mm size)																					
IS-2906	Sluice valves for water works purpose (350-1200 mm size)																					
IS-5150	Cast iron wedge and double disc gate for general purpose.																					
BS-5152	Specification for cast iron globe valves.																					
BS-5153	Cast iron check valves for general purpose.																					
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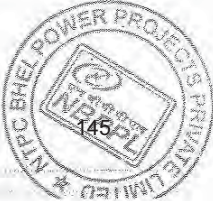


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	IS-5312 Swing check type reflux (non-return) valves. ANSI B 16.34 Standard for valves. API-594 Standard for Dual-check valves. API-600 Steel gate valves. ANSI-B-16.10 Valves face to face and other relevant dimension. API-598 Valves inspection test.	
2.13.04	End Connections The end connections, shall comply with the following: Socket welding (SW) - ANSI B 16.11 Butt Welding (BW) - ANSI B 16.25. Threaded (SC) - ANSI B 2.1 Flanged (FL) - ANSI B 16.5& AWWA-C-207(steel flanges), ANSI B 16.1 (Cast Iron flanges)	
2.13.05	All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).	
2.13.06	All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.	
2.13.07	All gun metal body valves shall have screwed ends.	
2.13.08	All flanged end valves/specialties. shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints.	
2.14.00	Check Valves	
2.14.01	Check valves shall comply with the following characteristics: (a) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal); (b) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.	
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	(c) In the case of swing check valves, the body seat shall be inclined at such an angle from the vertical as will facilitate closing and prevent chatter.	
2.14.02	Drilling on flanges of flanged valves must correspond to the drilling on flanges of the piping system on which the valves are to be installed.	
2.14.03	All flanged valves intended for installation in steel piping systems shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class.	
2.14.04	Counter flanges to be installed on air pipes shall be screwed-on type irrespective of size.	
2.15.00	Globe Valves	
2.15.01	The globe valves shall have the following characteristics: Straight conveyed flow. Right angle Preferably, the valves shall be of the vertical stem type.	
2.15.02	Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.	
2.15.03	The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.	
2.15.04	For the regulating valves, valves with regulating plug & parabolic outline disc type is preferred.	
2.15.05	All motorized globe valves with regulating plug for which indication of percentage (%) opening are required in the control room shall be provided with necessary position transmitter.	
2.16.00	Gate valves All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate. Gate valves shall be of the solid/elastic or articulated wedge disc and rising stem type.	
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2.17.00	Air Release Valve (a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint. (b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure. (c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260. and spindle shall conform to high tensile brass. (d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/ butterfly valve.	
2.18.00	Butterfly valves	
2.18.01	Design/Construction (a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm nb diameter. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition. Bidder has to clearly indicate the material offered in the bid. No change shall be entertained during detailed engg. (1) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable (2) The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable. (3) For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.	
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CLAUSE NO.	TECHNICAL REQUIREMENTS	06961 एनटीपीसी NTPC
	(4) The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information. (5) The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration. (6) The operating mechanism shall be mounted directly on or supported from the valve body. (7) All valves shall be complete with: Position indicator (located in a visible place) Arrow indicating the flow direction; Adjustable mechanical stop limiting devices to prevent over Travel of valve disc in open/close position. All valves shall be "tight shut off" (8) Hand operated valves shall have the following Local hand controls The hand controls shall close the valve with clockwise rotation. The hand controls shall be dimensioned to guarantee an easy maneuver under most severe conditions. The hand controls shall be provided with locking systems suitable to avoid the disc assuming a non-desirable position during the operation. Hand wheel shall be made of malleable iron with arms and rims of adequate strength. The hand wheel of diameters 300mm or less shall be provided with handles for ease of operation. The pulling force required on the hand wheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure.	
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