

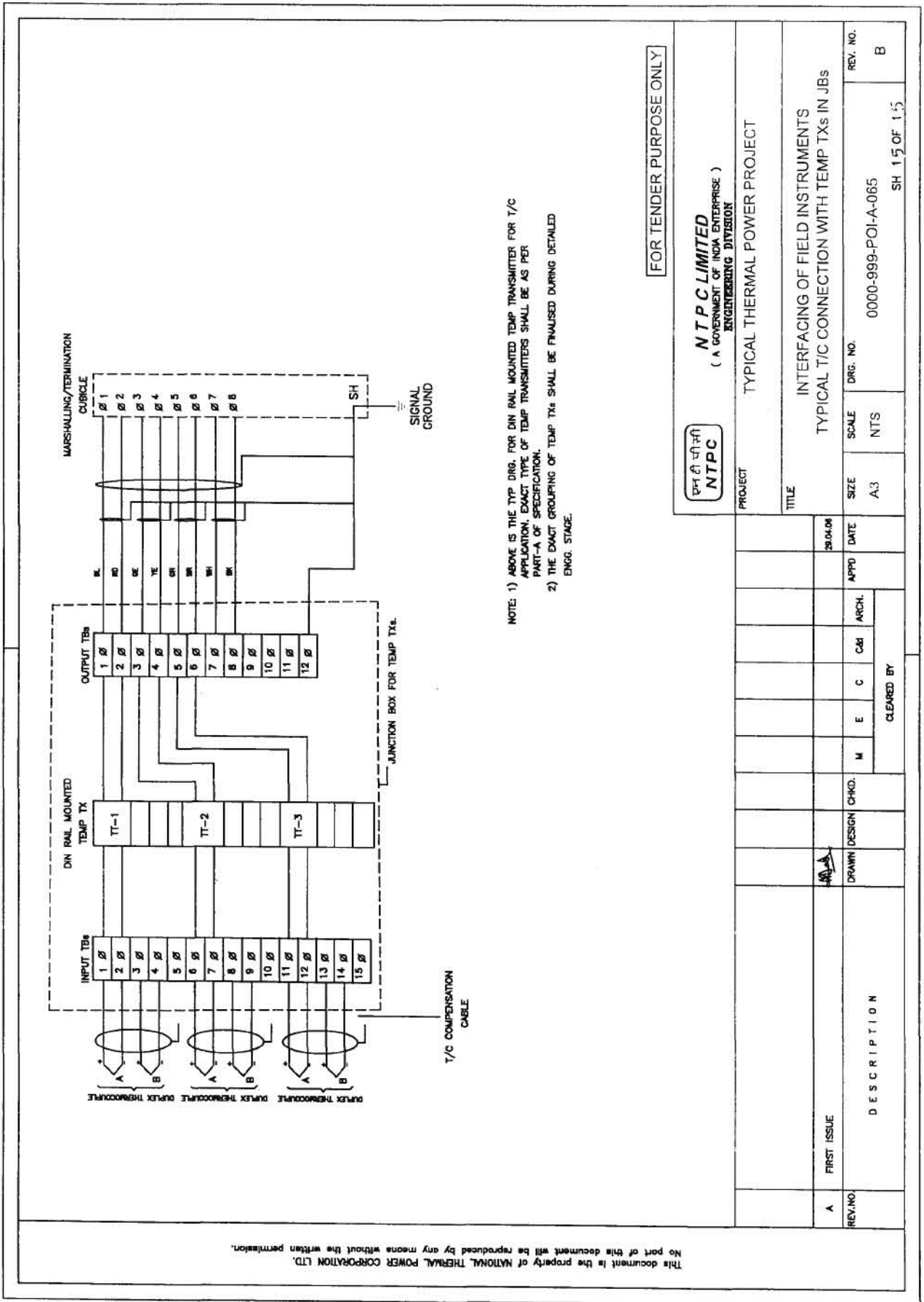
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FOR TENDER PURPOSE ONLY

एन टी पी सी लिमिटेड
NTPC LIMITED
 (A GOVERNMENT OF INDIA ENTERPRISE)
 ENGINEERING DIVISION

PROJECT	TYPICAL THERMAL POWER PROJECT		
TITLE	INTERFACING OF FIELD INSTRUMENTS INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR (Elect. Brkr. - Non Sync.-HT)		
SIZE	A3	SCALE	NTS
DATE	14.02.08	DRG. NO.	0000-999-POI-A-065
REV. NO.	B	SH	14 OF 14

REV. NO.	B	DESCRIPTION	Revised for Numerical relay based SWGR
DATE	14.02.08	ARCH.	
CHECKED BY		CAD	
DESIGNED BY		CLEAR BY	
DRAWN		DESIGN CHD.	



NOTE: 1) ABOVE IS THE TYP. DRG. FOR DIN RAIL MOUNTED TEMP TRANSMITTER FOR T/C APPLICATION. EXACT TYPE OF TEMP TRANSMITTERS SHALL BE AS PER PART-A OF SPECIFICATION.
 2) THE EXACT GROUPING OF TEMP TXs SHALL BE FINALISED DURING DETAILED ENGG. STAGE.

FOR TENDER PURPOSE ONLY

NTPC LIMITED
 (A GOVERNMENT OF INDIA ENTERPRISE)
 ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
 TYPICAL T/C CONNECTION WITH TEMP TXs IN JBS

DATE: 20.04.08

SCALE: NTS

SIZE: A3

DRG. NO: 0000-999-POI-A-065

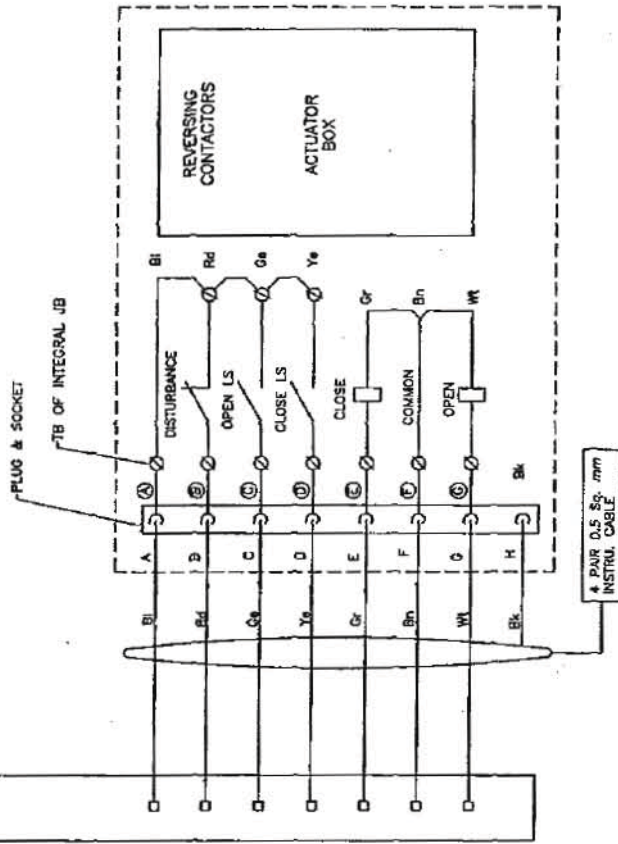
REV. NO: B

SH 15 OF 15

REV. NO.	DESCRIPTION	DATE	APPD.	CHKD.	DESIGN	ARCH.	C&I	ARCH.	CLEARED BY
A	FIRST ISSUE	20.04.08							

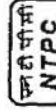
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TERMINATION AT CONTROL SYSTEM END



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FOR TENDER PURPOSE ONLY



NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT	TYPICAL THERMAL POWER PROJECT		
TITLE	INTERFACING OF ACTUATORS		
SIZE	A3	SCALE	N.T.S.
DRG. NO.	0000-999-POI-A-063		
REV. NO.	A		

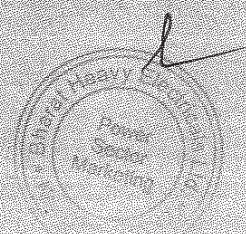
DATE	7/3/06	ARCH.	Ag
DESIGNED BY		CHECKED BY	
DRAWN		DESIGN	
CHKD.			
M	E	C	
CLEARED BY			
DESCRIPTION			
A	FIRST ISSUE		
REV/NO			



SUB-SECTION-VII:Q13

MEASURING INSTRUMENTS

742
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LARA SUPER THERMAL POWER PROJECT (2x800MW) /
DARLIPALI SUPER THERMAL POWER PROJECT -I (2 x 800MW) /
GAJMARA SUPER THERMAL POWER PROJECT -I (2x 800MW) /
KUDGI SUPER THERMAL POWER PROJECT -I (3 x 800MW)
STEAM GENERATOR PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC NO.: CS-9548/ 9549/ 9566/ 9573-102-2

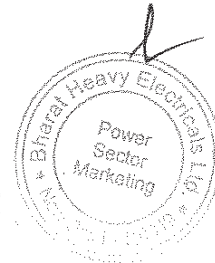
CLAUSE NO.

QUALITY ASSURANCE

एनटीपीसी
NTPC

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

TESTS ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (if applicable)(R)	Hydro Test(R)	Material Test certificate ®
1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch (BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter(IEC-770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Recorder(IS-9319/ANSI C-39.4)	Y	Y	Y	Y	Y	Y			
7. Vertical indicators	Y	Y	Y	Y		Y			
8. Digital Indicators	Y	Y	Y	Y		Y			
9. Integrators	Y	Y	Y	Y					
10. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
11. Transducer (IEC-688)	Y	Y	Y	Y	Y	Y			
12. Thermocouples (ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
13. RTD(IEC-751)	Y	Y	Y	Y	Y	Y			
14. Thermowell	Y		Y				Y	Y	Y
R-Routine Test A- Acceptance Test Y – Test applicable									
: Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions									
2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.									



743

LARA STPP (2x800MW) /
DARLIPALI STPP-I (2 x 800MW) /
GAJMARA STPP-I (2x 800MW) /
KUDGI STPP-I (3 x 800MW)
STEAM GENERATOR PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC NO.: CS-9548/ 9549/ 9566/
9573-102-2

PART-B
SUB-SECTION-VII:Q13
Meas. Inst. Cable

PAGE
1 OF 3

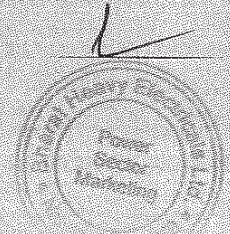


SUB-SECTION-VII:QI8

ELECTRICAL ACTUATOR WITH INTEGRAL STARTER



754



LARA SUPER THERMAL POWER PROJECT (2x800MW) /
DARLIPALI SUPER THERMAL POWER PROJECT -I (2 x 800MW) /
GAJMARA SUPER THERMAL POWER PROJECT -I (2x 800MW) /
KUDGI SUPER THERMAL POWER PROJECT -I (3 x 800MW) /
STEAM GENERATOR PACKAGE

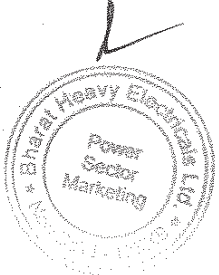
TECHNICAL SPECIFICATION
SECTION-VI
BID DOC NO.: CS-9548/ 9549/ 9566/ 9573-102-2

ELECTRICAL ACTUATOR WITH INTEGRAL STARTER													
Test/Attributes Characteristics													
ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator®	EPT output®	Grease leakage®	Local/ Remote (Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR WITH INTEGRAL STARTER(IS 9334)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions 2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.													
® - Routine Test (A) - Acceptance Test Y - Test applicable													

L



755





SUB-SECTION-VII:QI5

PROCESS CONNECTION AND PIPING



748

LARA SUPER THERMAL POWER PROJECT (2x800MW) /
DARLIPALI SUPER THERMAL POWER PROJECT - I (2 x 800MW) /
GAJMARA SUPER THERMAL POWER PROJECT - I (2x 800MW) /
KUDGI SUPER THERMAL POWER PROJECT - I (3 x 800MW)
STEAM GENERATOR PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC NO.: CS-9548/ 9549/ 9566/ 9573-102-2



**COMPRESSED AIR SYSTEM
2X 800MW DARLIPALLI STPP**


DOCUMENT NO.: PE-TS-395-555-A001

VOLUME- IIB

SECTION-C4

REV. 0

**VOLUME - II B
SECTION C4
SUB VENDOR LIST**

		SUB VENDOR LIST & INSPECTION CATEGORISATION			
COMPRESSED AIR SYSTEM					
SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Remarks
1	HOC / REACTIVATED BLOWER TYPE ADP	I	DELAIR	GURGAON	
			SUMMITS	COIMBATORE	
			MELLCON	NEW DELHI	
			ATLAS COPCO Testing at Atlas Copco Works - Pune	Belgium (Pune)	Only for MD type Air Drying Plant
2	MS/GI Pipes –ERW IS 1239 / IS 3589 (Quantity < 200 meters Assorted sizes)	III	SAIL	Rourkela	Material will be accepted on the basis of Main contractor COC supported by manufacturer TC as per relevant Code. In addition to above main contractor will certify availability of correlated identification marks on pipe wrt Manf TC and will also certify that pipes are free from rust
			Jindal (upto 350NB)	Ghaziabad	
			Surya Roshni (upto 400NB)	Bahadurgarh	
			Tata (upto 150NB) IS 1239 Pipes	Jamshedpur	
			Maharashtra seamless (200 to 500 NB) IS 3589	Raigad	
3	Forged/Formed fittings	III	EBY	Taloja	
			Siddarth & Gautam	Faridabad	
			Pipefit	Baroda	
			MS Fittings	Kolkata	
			Tube Products	Baroda	
			Bharat Forge	Pune	
			NL Hazra	Kolkata	
4	Ball Valve	I	Precision Engg	Nasik	upto 400NB 150 class
			Microfinish Valves Ltd	Hubli	upto 50NB 800 class; 400 NB 300 class
			BDK engg Industries	Hubli	upto 50NB 800 class ; 400NB 150 class
			Flow chem. Industries	Ahemdabad	upto 50 NB 800 Class: 350NB 150 class
			Audco	Chennai	
			Akay India	Hubli	upto 50NB 800 class

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Remarks
5	CS/FS Gate/Globe/Check valves Upto 600 NB 150 Class, 50 NB 800 Class	III	Fouress	Mumbai/ Aurangabad	
			BDK	Hubli	
			Audco	Chennai	
			Leader	Jullundhar	
			KSB	Coimbatore	
			KBL	Kondhapuri	
6	Butterfly Valve (Upto 500 NB PN 16)	II	KBL	Kondhapuri	
			Fouress	Bangalore	
			Audco	Chennai	
			BDK	Hubli	
			Tyco	Halol	
			Inter Valve	Pune	
7	Air Receiver	I	Integrated Engineers	Mumbai	
			Diamond Fabricators	Pune	
			Parkaire	Delhi	
			Temasme Vesselex	Noida	
			United Engineering Works	Nasik	
8	Safety Relief Valve	III	LEADER	JALANDHAR	
			SPIRAX MARSHALL	PUNE	
			FISCHER SANMAR	CHENNAI	
9	Pr./Vacuum/Dp Gauges	III	Auxitrol	U.K	
			Switzer (for DP gauge)	Chennai	
			Budenburg	U.K	
			A.N.Instruments	Kolkata	
			Bells Control	Kolkata	
			Manometer India	Mumbai	
			H Guru	Muzzafarpur / Risra	
			General Inst.	Mumbai/Goa	
10	Pr./Vacuum/DP.switch	II*	Indfos Ind.	Ghazibad	* If the total Quantity is <= 10, then inspection category III. However, manufacturer TC to be submitted
		III	Barton Inst.system	USA	
		I*	Gauges Bourdon	Mumbai	
		II*	Switzer	Chennai	
11	Temperature Gauge	III	Budenburg	U.K	
			A.N.Instruments	Kolkata	
			Bells Control	Kolkata	
			H Guru	Muzzafarpur / Risra	
			General Inst.	Mumbai/Goa	
12	Temperature Transmitter	I	(ABB)	Faridabad / Germany	For Din Rail Type only
		II*	Yokogawa	Japan	* If the total Quantity is <= 10, then inspection category III. However, manufacturer TC to be submitted

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Remarks
		II*	Emerson (Rosemount)	USA	
13	Pr./DP Transmitter	I	(ABB) -2600T series	Faridabad/Italy	
		II*	Honeywell	USA/India	* If the total Quantity is <= 10, then inspection category III. However, manufacturer TC to be submitted
		III	Fuji	Japan	
		III	Emerson (Rosemount)	USA	
		II*	Emerson (Rosemount)	Daman	* If the total Quantity is <= 10, then inspection category III. However, manufacturer TC to be submitted
		II*	Yokogawa	Japan	* If the total Quantity is <= 10, then inspection category III. However, manufacturer TC to be submitted. Calibration at YIL Bangalore is acceptable
14	HT Motor for Air compressor	I	CGL	Mandideep	Upto 1600 KW, 6.6 KV; Upto 1310 KW, 11 KV
			Marathon Electric	Kolkata	Upto 6.6 KV, 750 KW
			BHEL	Bhopal	
			SIEMENS	Germany	
			Hyosung	Korea	
			Hyundai	Korea	
15	Flow Switch	III	Switzer	Chennai	
			Levecon	Kolkata	
			DK Instruments	Kolkata	
			Delta	UK	
			ITT Barton	USA	
16	Temp Sensor	III	Pyro Electric	Mumbai	
			Detriv	Mumbai	
17	Flow Indicator	III	Sigma	Mumbai	
			Eureca	Pune	
18	Auto Drain Trap	III	Main Contractor approved sources		
19	Dew point meter	III	GE Sensing	Ireland	
			Michell Instruments	UK	
			Shaw	UK	
20	Flow Meter / Rota Meter	III	Trac	Hyderabad	
			Eureca	Pune	
21	Level Indicator/ Gauge	III	Sigma	Mumbai	
			Levcon	Kolkata	
			Pune Techtrol	Pune	
			SBEM	Pune	
22	Solenoid Valve	III	HERION	GERMANY/ ITALY	
			ROTEX AUTOMATION LTD.	V V NAGAR/ BARODA	
			ASCO	CHENNAI	
			JEFFERSON	ARGENTINA	
			AVCON	MUMBAI	

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Remarks
23	Cable trays (max 300 meters)	III	INAR PROFILE	ANNAKAPALLI	
			ANAND UDYOG	THANE	
			MJ ENGG.	DELHI	
			INDIANA	MUMBAI	Galvanizing. At Karmatara
			TECHNO ENGG	CHANDIGARH	
			JAMUNA METAL	DELHI	
			INDUSTRIAL PERFORATION	KOLKATA	Galvanizing at Unistar
			VATCO	MUMBAI	Galvanizing At Sigma Mumbai
24	Cable Glands	III	SUNIL& COMPANY	KOLKATA	
			ARUP ENGG	KOLKATA	
			COMMET	MUMBAI	
			QUALITY PRECISION	KOLKATA	
25	Cable Lugs	III	DOWELLS	MUMBAI	
			CHETNA ENGG	NASIK	
			3D	VALSAD	
26	Control cable	I*	RADIANT CABLES	HYDERABAD	* FOR LENGTH LESS THAN 500 M TO BE CONSIDERED AS CAT-III
			HVPL	FARIDABAD	
			PARAMOUNT CABLES	ALWAR	
			NICCO	SHYAMNAGAR	
			UNIVERSAL CABLES	SATNA	
			ICL	RAJPURA	
			DELTON CABLE	FARIDABAD	
			KEI	BHIWADI	
			POLYCAB	DAMAN	
			TORRENT	NADIAD	
27	Instrument cable	I*	POLYCAB	DAMAN	* FOR LENGTH LESS THAN 500 M TO BE CONSIDERED AS CAT-III
			UNIVERSAL CABLES	SATNA	
			NICCO	KOLKATA	
			RELIANCE	BANGLORE	
			CORDS	BHIWADI	
			PARAMOUNT CABLE	KHUSKHERA	
			INCAB	PUNE	
28	Junction Box	III	Main Contractor Approved Sources		

NOTE :

1) THE ABOVE SUB-VENDOR AND INSPECTION CATEGORISATION IS TENTATIVE AND FOR TENDER ESTIMATION ONLY AND THE SAME SHALL BE FINALISED DURING DETAILED ENGINEERING WITH THE NTPC. ANY ADDITION OR DELETION OF SUB-VENDOR AS PER NTPC COMMENTS DURING DETAILED ENGINEERING SHALL BE BINDING ON CONTRACTOR WITHOUT ANY IMPLICATION TO BHEL.

2) INSP CAT I : FOR THOSE ITEMS THE QUALITY PLANS ARE APPROVED BY NTPC AND FINAL ACCEPTANCE WILL BE ON PHYSICAL INSPECTION WITNESS BY BHEL & NTPC.

3) INSP CAT II : FOR THOSE ITEMS THE QUALITY PLANS ARE APPROVED BY NTPC. HOWEVER NO PHYSICAL INSPECTION WILL BE DONE BY BHEL / NTPC. THE FINAL ACCEPTANCE BY BHEL / NTPC SHALL BE ON THE BASIS OF REVIEW OF DOCUMENTS AS PER QP.

4) INSP CAT III : FOR THOSE ITEMS FINAL ACCEPTANCE BY BHEL / NTPC BASED ON BIDDER'S COC.



**COMPRESSED AIR SYSTEM
2X 800MW DARLIPALLI STPP**


DOCUMENT NO.: PE-TS-395-555-A001

VOLUME- IIB

SECTION-C5

REV. 0

**VOLUME - II B
SECTION C5
DRAWINGS AND DOCUMENT**

	TITLE: COMPRESSED AIR SYSTEM 2X800 MW DARLIPALLI STPP	SPEC. NO. PE-TS-403-555-A001	
		VOLUME IIB	
		SECTION : C5	
		REV. NO. 00	

1. Schedule of drawings/ documents to be furnished by bidder in the event of award of contract is attached as Annexure I to this section. However, any additional drawing/ documents, if found necessary for completion of the engineering, the same shall be submitted by bidder without any price & delivery implication.
2. Bidder to note that during detailed engineering, drawings / documents shall be submitted through web based document management system in addition to hard / soft copies. Procedure for the same shall be informed after award of contract.
3. Number of hard prints required to be submitted shall be intimated to successful bidder during kick-off meeting of the package.

MDL FOR CAS PACKAGE FOR DARLIPALLI STPP (2X800MW)

ANNEXURE I TO SECTION C5										
"A" S NO	"B" VENDOR_DRG_NO.	"C" NTPC_DRG_NO.	"D" DRAWING TITLE	"E" PURPOSE	"F" BOI (Y/N)	"G" NAME OF BOI	"H" SCHEDULED SUBMISSION, DAYS FROM LOI DATE	"I" RESUBMISSION AFTER INCORPORATING COMMENTS (IN DAYS)	"J" COMMENTS / APPROVAL FROM BHEL & NTPC (IN DAYS)	
1	PE-V0-395-555-A001		QUALITY PLAN OF AIR COMPRESSOR	A-CUST	N	CAS	21	10	21	
2	PE-V0-395-555-A002		QUALITY PLAN OF AIR DRYING PLANT	A-CUST	N	CAS	21	10	21	
3	PE-V0-395-555-A003		QUALITY PLAN OF AIR RECEIVER	A-CUST	Y	CAS	25	10	21	
4	PE-V0-395-555-A004		QUALITY PLAN OF MOTOR	A-CUST	Y	CAS	21	10	21	
5	PE-V0-395-555-A005		2	A-CUST	Y	CAS	21	10	21	
6	PE-V0-395-555-A006		QUALITY PLAN OF BALL VALVE	A-CUST	Y	CAS	21	10	21	
7	PE-V0-395-555-A007		SUB-VENDOR LIST & INSPECTION CATEGORISATION SCHEDULE	A-CUST	N	CAS	15	10	21	
8	PE-V0-395-555-A101		TDS OF INSTRUMENT AIR & SERVICE AIR COMPRESSORS	A-CUST	Y	CAS	21	10	21	
9	PE-V0-395-555-A102		TDS OF AIR DRYING PLANT	A-CUST	N	CAS	21	10	21	
10	PE-V0-395-555-A103		TDS ,GA & CHARACTERISTIC CURVES OF MOTOR FOR AIR COMPRESSOR	I-CUST	Y	CAS	21	10	21	
11	PE-V0-395-555-A108		TYPE TEST CERTIFICATE OF COMPRESSOR MOTOR	A-CUST	Y	CAS	60	10	21	
12	PE-V0-395-555-A104		TDS & GA OF VALVES	I-CUST	Y	CAS	42	10	21	
13	PE-V0-395-555-A105		TDS OF INSTRUMENTS	I-CUST	Y	CAS	42	10	21	
14	PE-V0-395-555-A301		GA DRAWING OF INSTRUMENT & SERVICE AIR COMPRESSOR	I-CUST	N	CAS	21	10	21	
15	PE-V0-395-555-A302		GA DRAWING OF AIR DRYER	I-CUST	N	CAS	21	10	21	
16	PE-V0-395-555-A302(2 nos. sheets)		GA DRAWING OF AIR RECEIVER.	I-CUST	Y	CAS	25	10	21	
17	PE-V0-395-555-A401		COMPRESSOR HOUSE LAYOUT	A-CUST	N	CAS	30	10	21	
18	PE-V0-395-555-A501		P & I DIAGRAM OF AIR COMPRESSOR	I-CUST	N	CAS	21	10	21	
19	PE-V0-395-555-A502		P&I DIAGRAM OF AIR DRYER	I-CUST	N	CAS	21	10	21	
20	PE-V0-395-555-A503		P&I DIAGRAM OF COMPRESSED AIR SYSTEM WITHIN COMPRESSOR HOUSE	A-CUST	N	CAS	21	10	21	
21	PE-V0-395-555-A701		OPERATION & CONTROL PHILOSOPHY OF COMPRESSED AIR SYSTEM	A-CUST	N	CAS	42	10	21	
22	PE-V0-395-555-A702		ELECTRICAL & INTERNAL WIRING DIAGRAM FOR COMPRESSOR AND AIR DRYER PANEL.	I-CUST	N	CAS	50	10	21	
23	PE-V0-395-555-A751		ELECTRICAL FEEDER LIST	I-G-P	N	CAS	21	10	21	
24	PE-V0-395-555-A752		CONTROL CABLE SCHEDULE	I-G-P	N	CAS	60	10	21	
25	PE-V0-395-555-A753		I/O List for CAS system.	I-CUST	N	CAS	56	10	21	
26	PE-V0-395-555-A901		CAS PG TEST PROCEDURE	A-CUST	N	CAS	75	10	21	
27	PE-V0-395-555-A903		O&M MANUAL-COMP AIR SYSTEM	I-CUST	N	CAS	90	10	21	



**COMPRESSED AIR SYSTEM
2X 800MW DARLIPALLI STPP**


DOCUMENT NO.: PE-TS-395-555-A001


VOLUME- IIB


SECTION-D


REV. 0

**VOLUME - II B
SECTION D
TECHNICAL DATA SHEET
(To be filled by Bidder)**

CLAUSE NO.	Bidder's Name			
	COMPRESSED AIR SYSTEM			
1.00.00	AIR COMPRESSOR	INSTRUMENT AIR (IA)	SERVICE AIR (SA)	
1.01.00	Capacity selection (in NM³/min)			
	a) SG & Its auxiliaries requirement per unit	.....		.....
	b) TG & its auxiliaries / Unit	.....		.....
	c) Water Treatment Plant	.....		.....
	d) Station C&I System	.....		.....
	e) Selected Capacity as per design criteria specified (in NM ³ /min)	.....		.....
1.02.00	General Data			
	(a) Manufacturer name	.....		.....
	(b) Model No.	.....		.....
	(c) Type of compressor	.....		.....
	(d) Total numbers offered	.....		.....
1.03.00	Guaranteed Performance			
1.03.01	Capacity of each compressor (NM ³ /min.) considering design ambient condition	.....		.....
1.03.02	Discharge pressure {(Kg/cm ² (g))} at Compressor HP outlet	.....		.....
1.03.03	Discharge pressure {(Kg/cm ² (g))} of Instrument Air at ADP Outlet	.....		.....
1.03.04	KW input required at the compressor shaft at design condition	.....		.....
1.03.05	Guaranteed power consumption at motor input terminals at rated conditions (i.e. without any tolerance)	.....		.....
1.03.11	KW rating of drive motor	.....		.....
1.03.12	Drive motor speed (rpm)	.....		.....
1.03.13	Guaranteed Power Consumption of ADP	.....		.....
1.03.14	Whether the Material of Construction of compressor is as per Specification?		YES / NO	
NAME OF THE ROJECT..... STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9548/ 9549/ 9566/ 9573-102-2	PART-F SUB-SECTION : DM8	PAGE 1 OF 4

CLAUSE NO.	Bidder's Name				
2.00.00	AIR RECEIVERS				
2.01.00	Design code	.....		
2.02.00	Design Pressure [Kg/cm ²]	.....		
2.03.00	Material of Construction	.....		
2.04.00	Number of Air receivers & capacity	.....		
3.00.00	INTERCOOLER, AFTER COOLER & HEAT EXCHANGERS OF ADP	Inter cooler	After cooler	Heat Exchan-ger (in case of type)	Dehumidier Blower (in case of HOC type)
3.01.00	Numbers per compressors or per ADP offered (as the case may be)	.....	.....	.....	.....
3.02.00	Temperature, deg.C. (a) Compressed air inlet/outlet (b) Cooling water inlet/outlet deg.C	.....			.....
3.03.00	Moisture separator provided as per specification?	Yes/No	Yes/No	Yes/No	Yes/No
3.04.00	Level gauge, automatic drain trap etc provided as per specification?	Yes/No	Yes/No	Yes/No	Yes/No
3.05.00	Whether the Material of construction is as per Specification?	-----YES / NO -----			
4.00.00	AIR DRYING PLANT				
4.01.00	Manufacturer	.....		
4.02.00	Type of ADP offered (Strike out whichever is not applicable)	Open Through(Blower Reactivated) type / HOC Type			
4.03.00	Number of drying plants offered	.....		
4.04.00	Whether two adsorber vessel is provided for each ADP ?	YES / NO			
4.05.00	Design airflow, at plant inlet NM ³ /min	.....		
4.06.00	Guaranteed dew point at the outlet throughout the operating cycle at atmospheric pressure	.....		
4.07.00	Max. pressure drop in the air steam	.....		
NAME OF THE ROJECT..... STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9548/ 9549/ 9566/ 9573-102-2	PART-F SUB-SECTION : DM8	PAGE 2 OF 4	

CLAUSE NO.	Bidder's Name		
4.08.00	Whether Filters provided as per Specification ?	YES / NO	
4.09.00	Reactivation Blower (in case of open through heat reactivated ADP)	.....
	(a) Capacity & Head	.....
	(b) Nos. per ADP	.....
	(c) KW Rating for the Blower motor	.....
4.10.00	Electric Heater (in case of open through heat reactivated ADP) or for HOC type ADP for temperature stabilization		
	(a) Type	.....
	(b) Nos. per ADP	.....
	(c) KW Rating/heating element	.....
4.11.00	Guaranteed Power consumption per cycle for ADP (KW)		
	(a) For Blowers	.....
	(b) For Heaters	.....
5.00.00	COMPRESSOR HOUSE CRANE (E.O.T. TYPE)		
	(a) Manufacturer	.....
	(b) Type	.....
	(c) Number offered	.....
	(d) Crane capacity (Tonne)	.....
6.00.00	a) Cooling water required for Air Compressors (per compressor) - M ³ /hr. (including after cooler)	.....
	b) Temperature rise across compressor inter cooler after cooler (deg.C)	.....
	c) Cooling water required for each ADP (including all heat exchanger) - M ³ /hr.	.....
NAME OF THE ROJECT..... STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9548/ 9549/ 9566/ 9573-102-2	PART-F SUB-SECTION : DM8	PAGE 3 OF 4

CLAUSE NO.	Bidder's Name			
7.00.00	<p>d) Temperature rise across ADP circuit (deg.C)</p> <p>Complete Instrumentation & Controls along provided as per specification for compressors and Air Drying Plants ?</p> <p style="text-align: right;">Yes/No</p>			
NAME OF THE ROJECT..... STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9548/ 9549/ 9566/ 9573-102-2	PART-F SUB-SECTION : DM8	PAGE 4 OF 4	



**COMPRESSED AIR SYSTEM
2X 800MW DARLIPALLI STPP**

DOCUMENT NO.: PE-TS-395-555-A001

VOLUME- IIB

SECTION-E

REV. 0

**VOLUME - II B
SECTION E
QUALITY ASSURANCE**

CLAUSE NO.	QUALITY ASSURANCE			<div style="border: 1px solid black; padding: 2px; display: inline-block;"> एनटीपीसी NTPC </div>
1.00.00	AIR COMPRESSOR SYSTEM			
1.01.00	<p>AIR COMPRESSORS :</p> <p>a) All pressure parts shall be hydraulically tested at not less than 150% of design pressure prior to painting and lining, if applicable. The test pressure will be maintained for 30 minutes.</p> <p>b) All other parts including inter-connecting piping shall be hydraulically tested wherever possible, as per relevant codes.</p> <p>c) Ultrasonic testing shall be carried out on all forgings and shafts (if dia.>= 50mm) viz. Crank shaft, connecting rod, piston rod, etc. MPI/DP test will be done on machined areas of the above components.</p> <p>d) Pistons shall be subjected to DP testing.</p> <p>e) During assembly all clearances and alignments shall also be checked and recorded.</p> <p>f) Rotor shall be statically and dynamically balanced.</p>			
1.01.01	<p>PERFORMANCE TEST (SHOP TEST) :</p> <p>a) Performance test on the compressors shall be carried out in accordance with ISO:1217/eq.. The test shall also include demonstration of loading and unloading mechanism (Capacity control) and operation of safety valves.</p> <p>b) Power consumption at motor input terminal at rated capacity as well as at fully unloaded condition of all the compressor shall be measured.</p> <p>c) Vibration and noise level measurement will be done during shop performance test.</p> <p>d) Test shall be carried out on all compressors with contract drive motor where power consumption for compressors has been indicated as a guaranteed parameter</p> <p>e) Clearance on Type test requirements from Employer's Engg. Shall be reviewed prior to final clearance.</p>			
1.02.00	<p>INTAKE AIR FILTER & SILENCER</p> <p>Test for Capacity, Pressure drop and Efficiency shall be done as per manufacturer's standard.</p>			
1.03.00	<p>AIR RECEIVER, HEAT EXCHANGERS, MOISTURE SEPERATORS, AIR DRYING PLANT:</p> <p>a) Each finished vessel shall be hydraulically tested to 150% of the design pressure for a duration of 30 minutes.</p> <p>b) NDT on weld joints shall be as per respective code requirements or the minimum as specified below:</p> <p>(i) 100 % DPT on root run of butt welds.</p> <p>(ii) 100% DPT on all finished butt welds and fillet welds</p>			
LARA STPP (2x800MW) / DARLIPALI STPP-I (2 x 800MW) / GAJMARA STPP-I (2x 800MW) / KUDGI STPP-I (3 x 800MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9548/ 9549/ 9566/ 9573-102-2	PART-B SUB-SECTION-VII:QM6 AIR COMPRESSOR	PAGE 1 OF 2

CLAUSE NO.	QUALITY ASSURANCE			SECTION E	एनटीपीसी NTPC
1.04.00	<p>(iii) 10% RT on butt welds which shall include all T- joints.</p> <p>c) Tube to Tube sheet joint of the heat exchangers shall be subject to Mock-up test as per the relevant standards.</p> <p>d) Reactivation blowers shall be tested for FAD, temp. rise, noise & vibration. Rotating parts shall be dynamically balanced.</p> <p>e) Completely assembled ADP shall be pneumatically tested at design pressure for a duration of 5 minutes. Functional and sequential operation testing of the completely assembled ADP shall be demonstrated at shop. Other accessories shall be tested as per relevant code and sections. Dew point measurement shall be done .</p> <p>H.O.T. CRANE :</p> <p>a) Chain pulley Blocks shall be tested as per IS: 3832.</p> <p>b) Following NDT requirements shall be met :</p> <p>(i) 100% RT of Butt welds in tension and 10% RT of butt welds in compression.</p> <p>(ii) DP at random on all weldments.</p> <p>Deflection, load, overload & travel check on HOT crane assembly shall be carried out as per IS:3177.</p>				
1.05.00	<p>PIPINGS, VALVES, FITTINGS AND OTHER SPECIALITIES</p> <p>Refer , relevant clauses as indicated in SG portion of Technical specification .</p> <p>All forgings, dia \geq 50 mm shall be Ultrasonic Tested irrespective of the type, size & rating of the valve.</p>				
LARA STPP (2x800MW) / DARLIPALI STPP-I (2 x 800MW) / GAJMARA STPP-I (2x 800MW) / KUDGI STPP-I (3 x 800MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9548/ 9549/ 9566/ 9573-102-2	PART-B SUB-SECTION-VII:QM6 AIR COMPRESSOR	PAGE 2 OF 2		



**COMPRESSED AIR SYSTEM
2X 800MW DARLIPALLI STPP**

DOCUMENT NO.: PE-TS-395-555-A001

VOLUME- IIB

SECTION-F

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**VOLUME - II B
SECTION F
SUGGESTIVE PRICE FORMAT**

Clause No.	DESCRIPTION	Qty.	Unit	Price percentage of total ex-works supply price at column 7.	Unit Ex-Works Price Duly Packed	Total Ex-Works Price Duly Packed (Rs)	Excise Duty Inclusive cess	CST / VAT	Freight inclusive Service Tax	Total "FOR" Site Prices (Rs.)	E & C Charges Inclusive service Tax	Grand Total
2.13	Control cable from Compressor House to HT Switch Gear & Signal cable between Compressor House & DDCMIS (SG C&I) as specified elsewhere in the Technical Specification	1	Lot	15 - 20 %								
2.14	Online Vibration monitoring system for all air compressors and its motors as specified	1	Lot									
2.15	Total lump sum prices for Maintenance Tool & Tackles (bidder to furnish item wise prices separately along with the price bid, as per format attached as Annexure I to this section).	1	Lot									
2.16	Total lump sum prices for commissioning spares (bidder to furnish lists of spares with item wise prices separately along with the price bid, as per format attached as Annexure II to this section).	1	Lot									
2.17	Total lumpsum prices for mandatory spares as specified for compressed air System. (Bidder to furnish unit prices for each item in the Mandatory spares list, Annexure III to this section, separately along with the price bid).	1	Lot	Actual price to be indicated.								
3.0	Bidder to indicate the following in their offer:											
3.1	Import content and currency (for each item separately)											
3.2	Rate of exchange											
3.2	Rate of customs duty assumed											

NOTES

- Bidder to note that in case there is any mismatch between lumpsum and break up price , higher of the two will be considered for evaluation and order will be placed on lower price in case the bidder happens to be L1
- Bidder must submit prices in the Pro Forma duly filled in signed and stamped on every page without any ambiguity. The price shall be written against each item. Term such as "refer covering letter" etc. are not acceptable. Extra sheet may be attached if the space provided is not sufficient
- Price format shall not be changed by the bidder

MANDATORY SPARES FOR STEAM GENERATOR PACKAGE FOR CAS					
DARLIPALLI STPP, (2 X 800 MW)					
SI. NO.	PARTICULARS	QUANTITY	Unit Ex-Works price (Rs.)	Total Ex-Works price (2 x 800 MW set) (Rs.)	Remarks
1.0.00	Oil free Screw Air Compressor (As applicable)				
1	H. P. Stage Complete HP Stage assembly consisting of high pressure element, Bearing for male and female rotors (drive end), Bearing for male and female rotors (non-drive end), Timing gears, Graphite ring shaft for compressor chamber seals or white metal labyrinth, suction valve, discharge valve, packing set, Axial thrust bearing, Labyrinth oil seal or radial seals or double acting seals for drive shafts.	1 Set of each type/rating			
2	L. P. Stage Complete LP Stage assembly consisting of high pressure element, Bearing for male and female rotors (drive end),Bearing for male and female rotors (non-drive end), Timing gears, Graphite ring shaft for compressor chamber seals or white metal labyrinth, suction valve, discharge valve, packing set, Axial thrust bearing, Labyrinth oil seal or radial seals or double acting seals for drive shafts.	1 Set of each type/rating			
3	Motor Bearings	2 Sets			
4	LP stage Gear and Pinion	1 Set			
5	HP stage Gear and Pinion	1 Set			
6	Air Intake Filter Element With Gaskets	4 Sets			
7	Oil Filter Element With Gaskets & Seals	4 Sets			
8	Safety Valve Springs and Gaskets for HP stage	1 Set			
9	Safety Valve Springs and Gaskets for LP stage	1 Set			
10	Valves (within the compressor house with actuators)	2 nos of each type/ratings/size.			
11	Oil Pump/Motor				
11.1	Oil Pump and Motor complete assembly	1 Set			
11.2	Pump impeller/rotor with shaft	1 Set			
11.3	Set of bearings	2 Set			
11.4	Set of Seals	2 Set			
12	DRAIN / MOISTURE TRAP	2 Set of each type/size.			
13	OIL COOLER GASKET & SEALS	2 sets			
2.0.00	Centrifugal Compressor (As applicable)				
1	Pinion Shaft journal Bearing Assembly	2 sets			
2	Thrust Bearing Assembly	2 sets			
3	Shaft Seals for Air-Oil (All stages)	2 sets			
4	Gasket / O rings	3 Sets of each type/size.			
5	Air Intake Filter Elements	4 Sets of each type/size.			
6	Lub Oil System				
6.1	Main oil pump complete	1 No			
6.2	Aux. oil pump complete	1 No			
6.3	Complete coupling for main & Aux. Oil pump, spacer	1 No			
6.4	Catridge filter elements with gaskets and seal	4 sets			
7	Motor Bearings	2 sets			
8	DRAIN / MOISTURE TRAP	2 Set of each type/size.			
9	OIL COOLER GASKET & SEALS	2 sets			
3.0.00	AIR DRYING PLANT (Twin tower type) FOR IA SYSTEM				
1	Pre filter element(Ceramic candle or as applicable)	2 sets			
2	After filter element(Ceramic candle or as applicable)	2 sets			
3	Heater element (if applicable)	1 set			
4	Blower bearing (if applicable)	1 set			
5	Blower motor bearing (if applicable)	2 sets			
6	Valves & Valve Actuators (pneumatic/hydraulic)	2 sets			
7	Heater coil for temperature stabilization (for HOC type)(as applicable)	2 sets			
	OR				
3.0.00	AIR DRYING PLANT (Rotary Drum type) FOR IA SYSTEM				
a)	Drum (with required bearings) assembly packed with desiccant	2 sets			
b)	Drive assembly (for dryer) consisting of motor, gear boxes, drive shaft & coupling	1 set			
4.0.00	Valves	5% of the total population of each type, size and class OR minimum 2 nos. of each type, size and class whichever is more.			Complete valve along with Actuators (pneumatic / hydraulic) and all other accessories which are the part of original supply shall be supplied

MANDATORY SPARES FOR STEAM GENERATOR PACKAGE FOR CAS					
DARLIPALLI STPP, (2 X 800 MW)					
SI. NO.	PARTICULARS	QUANTITY	Unit Ex-Works price (Rs.)	Total Ex-Works price (2 x 800 MW set) (Rs.)	Remarks
5.0.00	Electrical Actuators				
1	Power unit for modulating actuator	One of each type & size			
2	DC-DC unit/power pack units	One of each type & size			
3	Electronic cards	1 set			
4	Position feed back transmitters	One of each type & size			
5	Control unit	1 no. of each type			
6	Torque and limit switch assembly of each unit	1 no. of each type			
7	Actuators	One of each type make & rating			
6.0.00	MEASURING INSTRUMENTS				
1	Electronic Transmitters				
1.1	Transmitters of all types, ranges and model no. (for the measurement of Pressure,differential pressure flow, level, etc.)	10% or 1 no. of each type and model, whichever is more.			
1.2	Level Transmitters (Ultrasonic/ radar type)	50% of each type and length, including sensors			
2	Temperature elements				
2.1	RTD's* of each type and length(with head assembly, terminal block & nipple)	10% or 2 nos. of each type and length, whichever is more			
2.2	Thermocouples of each type like K-type, R-type, metal etc. * (with head assembly, terminal block & nipple)	10% or 2 nos. of each type and length which ever is more			
2.3	Thermowell for application like mill outlet temperature and SH/RH/Eco/ flue gas temp. in furnace	10% or 2 nos. of each type and length whichever is more			
2.4	Temperature transmitters	10% of each type and length			
3	Local Indicators like temperature gauges, pressure gauges, differential pressure gauges, flow gauges, flow meters etc.,	5% or 1 no. of each make, model and type whichever is more (to be divided to various ranges in proportion to main of all make, model, type population)			
4	Process Actuated Switch Devices Includes all types of Pressure, differential pressure, flow, temperature, differential temperature, level switch Devices	5% or 1 no. of each type and model whichever is more			
5	PD Type Flow Transmitters	1 no. of each type and model			
6	Instruments within Compressor Skid	10% or 2 nos. of each type and length, whichever is more			
7	Instruments within Drier Skid	10% or 2 nos. of each type and length, whichever is more			
7.0.00	INSTRUMENTATION CABLE, INTERNAL WIRING & ELECTRICAL FIELD				
1	Pre fabricated cable of each type.	10% of installed quantity			
2	Pre fabricated cable connector of each type	10% or 1 no. of each type and model, whichever is more.			
3	Other cables	5% of each type, pair and size of actual installed quantity			
8.0.00	POWER SUPPLY SYSTEM (24 V DC power supply system) (To be provided for each system)				
1	Silicon controlled thyristors, diodes, power transistors	100%(1 Lot)			
2	Capacitors	1 set			

MANDATORY SPARES FOR STEAM GENERATOR PACKAGE FOR CAS					
DARLIPALLI STPP, (2 X 800 MW)					
SI. NO.	PARTICULARS	QUANTITY	Unit Ex-Works price (Rs.)	Total Ex-Works price (2 x 800 MW set) (Rs.)	Remarks
3	Fuse free Circuit breakers	5% or 1 no. of each type and rating, whichever is more			
4	Electronic modules of all types.	20% or 2 nos. of each type and model, whichever is more			
5	Cooling Fans	10% or 2 nos. of each type, whichever is more.			
6	Indication Lamps	200%			
7	Lamp holders with series resistor, if any	20%			
8	Digital / analog panel meters / indicators	10%			
9	Relays of all types including overload relays	20%			
9.0.00	PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING / TUBING AND AIR SUPPLY PIPING AS APPLICABLE)				
1	Valves of all types and models	10% or 1 no. of each type, class, size and model whichever is more			
2	2 way, 3way, 5way valve manifolds	10% or 1 no. of each type, class, size and model whichever is more			
3	Fittings	10% or 1 packet of each type, class, size and model whichever is more.			
4	Purge meters	5% of each model or 1 no. whichever is more.			
5	Filter regulators	20% of each model or 2 nos. whichever is more.			
10.0.00	CONTROL VALVES, ACTUATORS & ACCESSORIES				
1	Pneumatic and electro-hydraulic actuator assembly	10% or 1 no. of each type, model and rating, whichever is more			
2	Valve trim (including cage, plug, stem, seat rings,guide bushings etc.)	1 set for each type of control valve.whichever is more.			
3	Diaphragms, O' rings, seals etc. of all types, make etc.	200%			
4	Pressure Gauges of all types, make, rating etc.	10% or 2 nos. of each type whichever is more.			
5	Solenoid valves (if applicable)	10% or 2 nos. of each type whichever is more.			
6	Positioner units (complete unit)	10% or 1 nos. of each type whichever is more.			
7	Pneumatic air-filter/Regulator of each type, make, rating etc.	10% or 2 nos. whichever is more.			
8	Air lock relays	10% or 2 nos. of each type whichever is more.			
11.0.00	MICROPROCESSOR BASED/PLC BASED CONTROL SYSTEM FOR AIR COMPRESSOR & DRYER UNIT				
1	Complete set including integral microprocessor based control system alongwith system & application software and special cables	10% or 1 nos. which ever is more			



**COMPRESSED AIR SYSTEM
2X 800MW DARLIPALLI STPP**

DOCUMENT NO.: PE-TS-395-555-A001

VOLUME- IIB

Annexures

REV. 0

**VOLUME - II B
ANNEXURES**

FORMAT FOR NO DEVIATION CERTIFICATE

BHARAT HEAVY ELECTRICALS LIMITED,
Power Sector – Project Engineering Management,
PPEI Building,HRD & ESI Complex,
Plot no. 25, Sec.16A
Noida – 201301(UP)

DATE:

Sub	No Deviation Certificate.	
Job	Design, manufacturing, supply, erection, testing & commissioning of compressed air system for 2x800 MW DARLIPALLI STPP	
Ref	1.0	Tender document no
	2.0	BHEL's NIT vide reference no.
	3.0	BHEL's Amendment vide reference no.
	4.0	All other pertinent issues till date.

Dear Sirs,

With reference to above, this is to confirm that as per tender conditions, we have visited site before submission of our offer and noted the job content & site conditions etc. We also confirm that we have not changed/ modified the tender documents and in case of observance at any stage, it shall be treated as null and void.

We hereby confirm that we have not taken any deviation from tender clauses together with other references as enumerated in above referred NIT and convey our unqualified acceptance to all terms and conditions as stipulated in the tender and NIT.

We hereby confirm to unqualified compliance to technical specification together with other references as enumerated in above referred NIT.

In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted offer strictly in accordance with above.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)

Annexure IV

DARLIPALLI STPP (2x800 MW)**Compressed air package**

Guaranteed Power Consumption for Air Compressor System shall be as per following:

S.No (1)	Description of Equipment (2)	Nos. of Equipment to be considered for guaranteed power consumption (3)	Total Guaranteed Power Consumption for Each Equipment at motor input terminal. (4)	Duty factor (5)	Total (kW) (6)=(3)*(4)*(5)
1.0	Service Air Compressor of 60 Nm ³ /min at 8.0 kg/cm ² (g).	1		1	
2.0	Instrument Air Compressor of 60 Nm ³ /min at 8.0 kg/cm ² (g).	1		1	
3.0	Air Drying Plant for IA.	1		1	

TOTAL (KW)

Notes:

- 1.0 Base figure of Aux. Power consumption as per above criterion for CAS (for working drives only) shall be **1100 kW (Per Unit)**.
- 2.0 Bidder's guaranteed power consumption at motor input terminals (not shaft power) as furnished in guaranteed schedule shall be demonstrated by the successful bidder during performance testing at works/site.
- 3.0 The price quoted by the bidder shall be loaded US \$ **2,258/-** for every additional kW increase in consumption from the base figure indicated at Note no. 1.0 above.
- 4.0 In case the successful bidder fails to establish / prove the guaranteed values of power consumption (base figure of auxiliary power consumption) on actual performance testing at the manufacturing works / site, penalty US \$ **2,258/-** per kW increase in power consumption figure shall be levied.

Annexure V

List of Drawings, for tender estimation purpose only, enclosed with the technical specification

SNO	DESCRIPTION	DRG NO
1	GENERAL LAYOUT PLAN	9549-999-POC-F-001
2	PID COMPRESSOR COOLING WATER SYSTEM	PE-DG-403-165-N001
3	PID FOR COMPRESSOR HOUSE	PE-DG-403-555-A501
4	SCHEMATIC DRAWING OF COMPRESSED AIR SYSTEM.	0000-102-POM-A025
5	COMPRESSOR HOUSE LAYOUT	

SERIAL	EQUIPMENT	NO. OF UNITS	MANUFACTURER'S BRAND	UNIT PRICE IN INR	TOTAL PRICE IN INR	REMARKS
1	WATER COMPRESSORS	443	500	100	100	-
2	WATER COMPRESSORS	14	40	100	140	-

PIPE SIZES

NO.	DIAMETER (MM)	LENGTH (M)	WEIGHT (KG)
1	219	30	30
2	150	100	100
3	100	100	100
4	75	100	100
5	50	100	100
6	25	100	100
7	15	100	100
8	10	100	100
9	5	100	100
10	3	100	100
11	2	100	100
12	1.5	100	100
13	1	100	100
14	0.5	100	100
15	0.25	100	100
16	0.125	100	100
17	0.0625	100	100
18	0.03125	100	100
19	0.015625	100	100
20	0.0078125	100	100
21	0.00390625	100	100
22	0.001953125	100	100
23	0.0009765625	100	100
24	0.00048828125	100	100
25	0.000244140625	100	100
26	0.0001220703125	100	100
27	0.00006103515625	100	100
28	0.000030517578125	100	100
29	0.0000152587890625	100	100
30	0.00000762939453125	100	100
31	0.000003814697265625	100	100
32	0.0000019073486328125	100	100
33	0.00000095367431640625	100	100
34	0.000000476837158203125	100	100
35	0.0000002384185791015625	100	100
36	0.00000011920928955078125	100	100
37	0.000000059604644775390625	100	100
38	0.0000000298023223876953125	100	100
39	0.00000001490116119384765625	100	100
40	0.000000007450580596923828125	100	100
41	0.0000000037252902984619140625	100	100
42	0.00000000186264514923095703125	100	100
43	0.000000000931322574615478515625	100	100
44	0.0000000004656612873077392578125	100	100
45	0.00000000023283064365386962890625	100	100
46	0.000000000116415321826934844453125	100	100
47	0.0000000000582076609134674222265625	100	100
48	0.00000000002910383045673371111328125	100	100
49	0.000000000014551915228366855556640625	100	100
50	0.0000000000072759576141834277783203125	100	100
51	0.00000000000363797880709171388916015625	100	100
52	0.000000000001818989403545856944580078125	100	100
53	0.0000000000009094947017729284722900390625	100	100
54	0.00000000000045474735088642413614501953125	100	100
55	0.000000000000227373675443212068072509765625	100	100
56	0.0000000000001136868377216060340362548828125	100	100
57	0.0000000000000568434188608030170181274140625	100	100
58	0.00000000000002842170943040150550906370703125	100	100
59	0.000000000000014210854715200752754531853515625	100	100
60	0.0000000000000071054273576003763772676767890625	100	100
61	0.00000000000000355271367880018818863383839453125	100	100
62	0.000000000000001776356839400094094316919197265625	100	100
63	0.0000000000000008881784197000470471594595986328125	100	100
64	0.00000000000000044408920985002352357972979931640625	100	100
65	0.000000000000000222044604925011761789864899678203125	100	100
66	0.0000000000000001110223024625058808949324498391015625	100	100
67	0.0000000000000000555111512312529404471621224195703125	100	100
68	0.00000000000000002775557561562647022356110610959265625	100	100
69	0.0000000000000000138777878078132351117805505304828125	100	100
70	0.00000000000000000693889390390661755589027651614140625	100	100
71	0.0000000000000000034694469519533087779451382707203125	100	100
72	0.000000000000000001734723475976654389725691691350625	100	100
73	0.0000000000000000008673617379883271948628459547528125	100	100
74	0.00000000000000000043368086899416359743142297737640625	100	100
75	0.000000000000000000216840434497081798715711148868828125	100	100
76	0.00000000000000000010842021724854089935785574443440625	100	100
77	0.000000000000000000054210108624270449678927872222203125	100	100
78	0.0000000000000000000271050543121352248344639361111015625	100	100
79	0.00000000000000000001355252715606761241723171968055703125	100	100
80	0.0000000000000000000067762635780338062086085940278125	100	100
81	0.00000000000000000000338813178901690310432309701390625	100	100
82	0.000000000000000000001694065894505451521615493506953125	100	100
83	0.0000000000000000000008470329472527257605577467534765625	100	100
84	0.000000000000000000000423516473626363802788873376878125	100	100
85	0.00000000000000000000021175823681318150139443688890625	100	100
86	0.000000000000000000000105879118406590750697218444453125	100	100
87	0.0000000000000000000000529395592032953753486092222265625	100	100
88	0.000000000000000000000026469779601647668693011111328125	100	100
89	0.0000000000000000000000132348898008238343346505556640625	100	100
90	0.00000000000000000000000661744490041191716727777783203125	100	100
91	0.00000000000000000000000330872245020595883638888891640625	100	100
92	0.000000000000000000000001654361225102979418194444443440625	100	100
93	0.00000000000000000000000082718061255148989597222222203125	100	100
94	0.000000000000000000000000413590306275744947986111111328125	100	100
95	0.00000000000000000000000020679515313787248999305556640625	100	100
96	0.0000000000000000000000001033975765689372449994277783203125	100	100
97	0.00000000000000000000000005169878828446862249997166668828125	100	100
98	0.0000000000000000000000000258493941422343124999883333440625	100	100
99	0.000000000000000000000000012924697071111716249999416667203125	100	100
100	0.00000000000000000000000000646234853555858812499997083333640625	100	100

MAX. SPAN LENGTH

NO.	DIAMETER (MM)	LENGTH (M)	WEIGHT (KG)
1	219	30	30
2	150	100	100
3	100	100	100
4	75	100	100
5	50	100	100
6	25	100	100
7	15	100	100
8	10	100	100
9	5	100	100
10	3	100	100
11	2	100	100
12	1.5	100	100
13	1	100	100
14	0.5	100	100
15	0.25	100	100
16	0.125	100	100
17	0.0625	100	100
18	0.03125	100	100
19	0.015625	100	100
20	0.0078125	100	100
21	0.00390625	100	100
22	0.001953125	100	100
23	0.0009765625	100	100
24	0.00048828125	100	100
25	0.000244140625	100	100
26	0.0001220703125	100	100
27	0.00006103515625	100	100
28	0.000030517578125	100	100
29	0.0000152587890625	100	100
30	0.00000762939453125	100	100
31	0.000003814697265625	100	100
32	0.0000019073486328125	100	100
33	0.00000095367431640625	100	100
34	0.000000476837158203125	100	100
35	0.0000002384185791015625	100	100
36	0.00000011920928955078125	100	100
37	0.000000059604644775390625	100	100
38	0.0000000298023223876953125	100	100
39	0.00000001490116119384765625	100	100
40	0.000000007450580596923828125	100	100
41	0.0000000037252902984619140625	100	100
42	0.00000000186264514923095703125	100	100
43	0.000000000931322574615478515625	100	100
44	0.0000000004656612873077392578125	100	100
45	0.00000000023283064365386962890625	100	100
46	0.000000000116415321826934844453125	100	100
47	0.0000000000582076609134674222265625	100	100
48	0.00000000002910383045673371111328125	100	100
49	0.000000000014551915228366855556640625	100	100
50	0.0000000000072759576141834277783203125	100	100
51	0.00000000000363797880709171388916015625	100	100
52	0.000000000001818989403545856944580078125	100	100
53	0.0000000000009094947017729284722900390625	100	100
54	0.00000000000045474735088642413614501953125	100	100
55	0.000000000000227373675443212068072509765625	100	100
56	0.0000000000001136868377216060340362548828125	100	100
57	0.0000000000000568434188608030170181274140625	100	100
58	0.00000000000002842170943040150550906370703125	100	100
59	0.000000000000014210854715200752754531853515625	100	100
60	0.0000000000000071054273576003763772676767890625	100	100
61	0.00000000000000355271367880018818863383839453125	100	100
62	0.000000000000001776356839400094094316919197265625	100	100
63	0.0000000000000008881784197000470471594595986328125	100	100
64	0.00000000000000044408920985002352357972979931640625	100	100
65	0.000000000000000222044604925011761789864899678203125	100	100
66	0.0000000000000001110223024625058808949324498391015625	100	100
67	0.0000000000000000555111512312529404471621224195703125	100	100
68	0.00000000000000002775557561562647022356110610959265625	100	100
69	0.0000000000000000138777878078132351117805505304828125	100	100
70	0.00000000000000000693889390390661755589027651614140625	100	100
71	0.0000000000000000034694469519533087779451382707203125	100	100
72	0.000000000000000001734723475976654389725691691350625	100	100
73	0.0000000000000000008673617379883271948628459547528125	100	100
74	0.00000000000000000043368086899416359743142297737640625	100	100
75	0.000000000000000000216840434497081798715711148868828125	100	100
76	0.00000000000000000010842021724854089935785574443440625	100	100
77	0.00000000000000000005421010862427044967892787222265625	100	100
78	0.00000000000000000002710505431213522483446393611111328125	100	100
79	0.00000000000000000001355252715606761241723171968055703125	100	100
80	0.0000000000000000000067762635780338062086085940278125	100	100
81	0.00000000000000000000338813178901690310432309701390625	100	100
82	0.000000000		

