

7.00.00**INFORMATION/DATA REQUIRED**

The Bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. and also unit rates for application of each type of paint along with supply shall be furnished.

4 X 270MW BHADRADRI TPS AT MANUGURU

ANNEXURE - VII (DM WATER ANALYSIS)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

ANNEXURE-VII

CLAUSE NO.	PROJECT SYNOPSIS																			
	DM water Analysis																			
	<table><tr><th>Sl.No.</th><th>Characteristics</th><th>Value</th></tr><tr><td>1.</td><td>Silica (Max.)</td><td>0.02 ppm as SiO₂</td></tr><tr><td>2.</td><td>Iron as Fe</td><td>Nil</td></tr><tr><td>3.</td><td>Total hardness</td><td>Nil</td></tr><tr><td>4.</td><td>pH value</td><td>6.8 to 7.2</td></tr><tr><td>5.</td><td>Conductivity</td><td>Not more than 0.1 µs/cm excluding the effects of free CO₂</td></tr></table>	Sl.No.	Characteristics	Value	1.	Silica (Max.)	0.02 ppm as SiO ₂	2.	Iron as Fe	Nil	3.	Total hardness	Nil	4.	pH value	6.8 to 7.2	5.	Conductivity	Not more than 0.1 µs/cm excluding the effects of free CO ₂	
Sl.No.	Characteristics	Value																		
1.	Silica (Max.)	0.02 ppm as SiO ₂																		
2.	Iron as Fe	Nil																		
3.	Total hardness	Nil																		
4.	pH value	6.8 to 7.2																		
5.	Conductivity	Not more than 0.1 µs/cm excluding the effects of free CO ₂																		
	PASSIVATED DM WATER pH = 8.5 to 9.5																			

4 X 270MW BHADRADRI TPS AT MANUGURU

ANNEXURE - VIII

(APPROVED DESIGN MEMORANDUM OF CAS)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

06.07.15	01	Revised as per MOM dated 25.06.15.	PK	HK	SKB				
10.06.15	00	Revised in line with customer comments, given on design philosophy submitted in proposal stage	PK	HK	PK				
Date	Rev	Description of Revision	PREP	CHD	APPD				
CUSTOMER 		TELANGANA STATE POWER GENERATION CO. LTD.							
CUSTOMER' CONSULATNT 		DESEIN PRIVATE LTD.							
PROJECT		4X270MW BHADRADRI TPS, MANUGURU, KHAMMAM							
CONTRACTOR 		BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI.	DEPT CODE M		NAME	SIGN	DATE		
				DRN	PK	Sd/-	10.06.15		
				DESN	PK	Sd/-	10.06.15		
				CHD	HK	Sd/-	10.06.15		
JOB No. 411				APPD	PK	Sd/-	10.06.15		
STATUS	CONTRACT	BHEL Doc. No: PE-DC-411-555-A001				Rev: 01			
TITLE/ PACKAGE NAME		DESIGN PHILOSOPHY OF COMPRESSED AIR SYSTEM							

1. FUNCTION

The purpose of compressed air system is to supply plant air and instrument air through distribution system to the power plant – 4x270MW MANUGURU TPS.

2. GENERAL DESCRIPTION

The compressed air system is comprised of the instrument air system and the plant air system. Instrument air is required for the various pneumatically operated valves and instruments in the power plant, while plant air is required for general plant services.

3. DESIGN CRITERIA

3.1 SYSTEM DESIGN CRITERIA

Compressed air system includes the following:

3.1.1 Five (5) nos. (4W + 1S) Instrument air compressors and four (4) nos. (all working) Plant air compressor, including drives, intercoolers, after coolers, step up gearbox, silencer and other accessories.

3.1.2 Five (5) nos. (4W + 1S) air-drying plants (ADP) each suitable for connecting to individual instrument air compressor. Dryers shall be Heat of Compression (HOC) type i.e. Rotary Drum type or Conventional Twin tower type.

3.1.3 Intake air filters.

3.1.4 Fourteen (14) nos. Air receivers, 9 nos., i.e., one for each compressor near compressor house and 4 no. unit air receivers in 'BC' bay of 10 M³ capacity and 1 no air receiver of 2 M³ Capacity for DM Plant Area shall be provided, designed and constructed in accordance with the requirement of the ASME unfired pressure vessel code.

3.1.5 All interconnecting piping, valves, fittings, supports/hangers, control air tubing cooling water piping & valves for safe and satisfactory operation of air compressors, dryers & air receivers.

3.1.6 Controls & interlocks.



3.1.7 All instruments including the electronic on line dew point meter (**DPM having 4-20mA output & connected to DCS**) with suitable sampling connection and isolation valve at outlet of each air drying plant.



3.1.8 EOT Crane of 8T capacity (Electrically operated pendent controlled, overhead travelling type).

3.1.9 Following instruments for various services : 

S.N.	Instrument	Service
a	Bearing temperature detector (BTD)	For measuring / monitoring bearings temperature of all HT motors of compressors.
b	Resistance temperature detector (RTD)	For measuring / monitoring winding temperature of all HT motors of compressors.

c	Flow meter (Metal tube rotameter) 	For measuring flow in individual IA/SA header for each unit
d	Flow transmitter 	For measuring flow at DMCW outlet line of each IA/SA compressor.



3.1.10 Compressor motor current (4-20 mA signal) will be provided from HT switchgear & same shall be hooked to DCS.

3.2 EQUIPMENT DESIGN CRITERIA

3.2.1 AIR COMPRESSORS

3.2.1.1. The capacity of instrument air compressor shall be 30 NM³/min. Delivery pressure will be 8.0 Kg/cm² (g) at ADP outlet. Each compressor will be designed to deliver the nominal capacity at the required delivery pressure.



3.2.1.2. The capacity of Plant air compressor shall be 30 NM³/Min. Delivery pressure will be 8.5 Kg/cm² (g) at outlet of SA compressor.



3.2.1.3. Air compressors will be multi stage oil free, screw type.



3.2.1.4. The compressors' capacity will be designed for 45^o C DBT and 82% RH at atmospheric pressure & High flood level of RL +66.465m at site.

3.2.1.5. Testing of compressor will be as per ISO: 1217 / **ISO:5167**.

3.2.1.6. Air compressors will be designed for continuous operation with high efficiency to satisfy the performance requirement.

3.2.1.7. The HT motor name plate rating (at 50^o C ambient) shall have 10% margin over the input power requirement of the compressor at rated duty point. When the driver is not directly coupled to the compressor, due consideration will be made for losses in power transmission, in addition to the above margin.



3.2.1.8. Satisfactory operation in parallel will be ensured without any uneven load sharing, undue vibration, noise etc.

3.2.1.9. Noise level shall not exceed 85 dBA when measured at a distance of 1.0 m from equipment surface and at a height of 1.5 m above the ground level. Required acoustic enclosures may be provided to meet the above condition. The discharge blow off silencer and intake silencers shall be designed to meet the above noise limitation level.



3.2.1.10. Compressed air velocity shall be 10 m/sec in main header.

3.2.2 ROTORS

3.2.2.1. Rotors will be one-piece construction with a suitable forged carbon steel or stainless steel coated with resistant material to minimise leakage and wear.



- 3.2.2.2. The rotors will have an asymmetric profile, so as to keep leakage losses to a minimum and ensure high efficiency.
- 3.2.2.3. Highly precise timing gears will be mounted on the rotor shafts to maintain the rotors in correct relative position.
- 3.2.2.4. These gears will be designed to counteract the axial forces incurred in compression.
- 3.2.2.5. Rotors shall be dynamically balanced.

3.2.3 AIR DRYING PLANT

- 3.2.3.1. Air-drying plant shall be of heat of compression desiccant type (conventional or rotary drum type), drying by adsorption process through a desiccant medium.
- 3.2.3.2. Quality of outlet air from ADP shall be in accordance to ISO 8573-1. Quality for Instrument Air as follows.
 - a) Dew point at outlet of the air drying plant will be minus (-) 40° C at atmospheric pressure.
 - b) Dust particle size in instrument air will be less than five (5) micron.
 - c) Oil content of Instrument air will be less than 1-ppm wt / wt at 20 degree C with the system pressure at 8-kg/ cm² (g).
- 3.2.3.3. Desiccant shall be silica gel / activated alumina as per manufacturer's standard.
- 3.2.3.4. Material of Construction (MOC) of rotary drum type HOC dryer shall be as per reputed manufacturer standard.
- 3.2.3.5. Cooling water requirements for Air Compressor & Air driers shall be tapped from DMCW line.
- 3.2.3.6. **PLC / Microprocessor control of ADP (as applicable as per final selected ADP) shall be hooked to DCS for monitoring & data shall be made available in DCS HMI MIMIC (on OWS).**



3.2.4 AIR RECEIVER

- 3.2.4.1. The capacity of each air receiver shall be 10 M³ (nominal).
- 3.2.4.2. The air receivers will be vertical self-supporting cylindrical vessels with supporting legs for resting on their foundation.
- 3.2.4.3. Design Pressure for the air receiver shall be 10 kg/cm² (g).
- 3.2.4.4. The material of construction of shell, dished ends, flanges etc. of the air receivers shall be of carbon steel as per IS: 2062 or equivalent.
- 3.2.4.5. Air receiver shall be provided with nozzles, air release vents, safety valve, pressure gauge, temperature gauge, minimum 500 mm dia. manhole for inspection.

3.2.5 INTAKE FILTER

Dry type suction air filters will be provided at the compressor inlet to prevent dust and dirt from entering the cylinders. The filtering efficiency shall be 99 %, down to 2 microns. Sound suppressing characteristics will be considered in the filter design.

3.2.6 PIPING & VALVES (WITHIN COMPRESSOR HOUSE)

- 3.2.6.1. All interconnecting compressed air piping shall conform to IS 1239 heavy grade galvanised/IS 3589 Gr 410 galvanised to IS- 4736 or equivalent. The fitting shall either be same as the parent material or malleable iron to IS-1879(galvanised). Compressed air piping from air compressor to after cooler and other lines handling hot air will be suitably insulated so as to restrict surface temperature to 60 deg. C. The pipe joints will be screwed coupling type for sizes up to 50 NB and above 50 NB the same will be flanged.
- 3.2.6.2. All the distribution valves shall be ball valve type. Necessary auto drain shall also be provided at strategic points.
- 3.2.6.3. Water Piping shall be IS-3589 Gr.410 / IS-1239 Heavy.

3.2.7 VALVES

- a) Compressed Air Services:
- ◆ All airline valves shall be ball valve type. For compressed air application, valve material shall be galvanized cast carbon steel for size 50NB above and forged carbon steel for size 50 NB and below
- b) Water Service:
- ◆ Cast iron valves with GM internals as per IS-780/equivalent and other applicable standards above 50 mm size. Gunmetal valves as per IS-778/equivalent up to size 50mm.
- c) Auto drain trap for each air receiver shall be provided.
- d) Moisture traps at strategic locations shall be provided in the distribution network.

4. LAYOUT CONSIDERATIONS

- 4.1.1 Air compressors will be located indoor in a separate compressor room and EOT crane arrangement will be provided so that the heaviest component can be handled during maintenance.
- 4.1.2 The air receivers will be located outdoors adjacent to the compressor room. Other receiver necessary maintenance access will be provided in the layout.
- 4.1.3 Complete ADP equipment shall be preferably mounted on a skid and located indoor.

5. OPERATION, CONTROL & INSTRUMENTATION

- 5.1.1 The necessary instrumentation and control has been provided for safe and trouble free operation of compressed air system.
- 5.1.2 Individual compressor control shall be through microprocessor based control system as per manufacturer's standard. However, provision of START / STOP operation shall be provided in DDCMIS also. **4 nos. microprocessor controller shall be supplied as loose.**



- 5.1.3 Depending upon operational requirement each compressor can be selected and operated in following mode
- 5.1.3.1. Local Mode: Individual compressor is operated from Local Integral Control System.
- 5.1.3.2. Remote Mode: Individual compressor is operated through DDCMIS (only START / STOP)



5.1.4 All the process inputs (digital or analog), other than specific to compressors are taken directly to DDCMIS. Further, signals for monitoring from individual compressor may be required to be sent to DCS(not through daisy chain).

5.1.5 **The start / stop command & feedback signals for compressor shall be provided hard to DCS. Also there will be soft link connectivity to DCS for monitoring purpose. MIMIC shall also be developed in DCS HMI.** 

5.1.6 On tripping of the working compressor, the standby compressor shall come into operation automatically in case of very low pressure in the system.

5.1.7 Inter changeability of service air compressor to instrument air compressor shall be done manually.



5.1.8 Cooling water for compressed air system shall be tapped from DMCW line.

5.1.9 **5 sets of instruments located within compressor skid for protection purpose shall be provided as loose.**



6. POWER SUPPLY ARRANGEMENT

6.1.1 The power supply (rated voltage, frequency, phase) of the equipments will be 6.6 KV, 415 V +/- 10%, 3ph, 50 Hz +3% to -5%. 10% combined variation of voltage and frequency

7. REFERENCE DRAWINGS/DOCUMENTS

- P & I Diagram for Compressed Air system. Rev. 00
- Compressor house building layout
- IA & SA compressor sizing calculation, Annexure-I
- Air receiver sizing calculation, Annexure-II



8. SUB-VENDOR LIST FOR COMPRESSED AIR SYSTEM

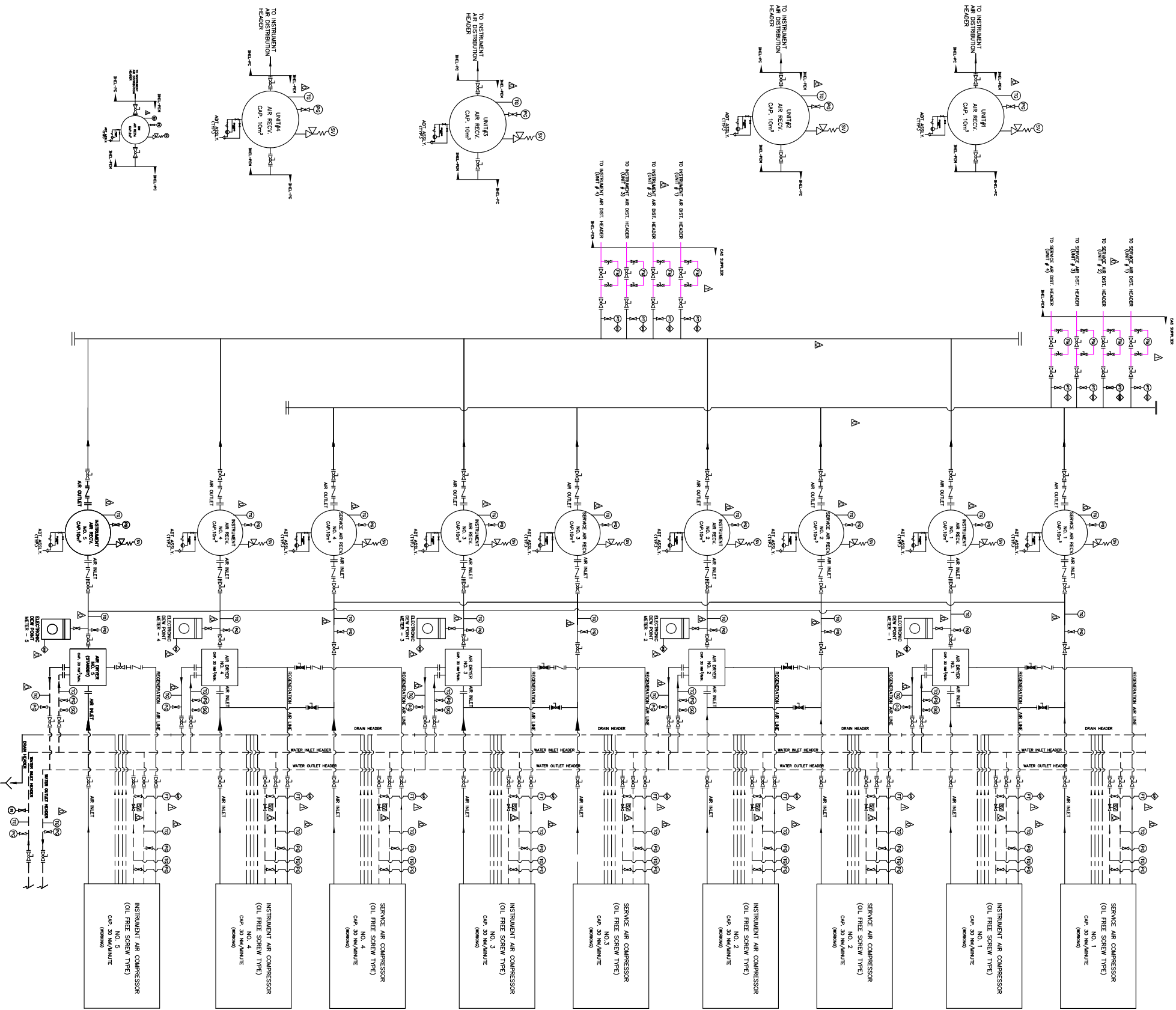


8.1.1 Sub-vendor items shall be approved by BHEL in line with Sl. no. E.2.31 of 2nd ERM dated 22.06.15. However C&I sub-vendor items, as agreed as part of resolution, shall be as per approved sub-vendor list of TSGENCO for Kothagundem as well as Bhadradi.

L E G E N D			
	BALL VALVE (OPEN)		TEMP. GAUGE
	BAL VALVE (CLOSED)		NON RETURN VALVE
	GLOBE VALVE (OPEN)		WATER
	GLOBE VALVE (CLOSED)		AIR
	RELIEF/SAFETY VALVE		DRAIN
	PRESSURE GAUGE		Y TYPE FUNNEL
	FLOW INDICATOR		FLOW TRANSMITTER
	ADT ASSLY. AUTO DRAIN TRAP ASSEMBLY		PRESSURE TRANSMITTER
	SIGHT GLASS		SOLENOID VALVE
	SIGNAL TO DCS		METAL TUBE ROTA METER

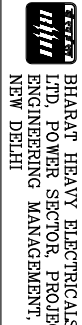
NOTES:-

1. THE GIVEN P&ID IS CONFINED TO INSTRUMENTS AND PIPING FOR COMPRESSOR HOUSE AREA ONLY
2. ALL INTERCONNECTING COMPRESSED AIR PIPING SHALL CONFORM TO IS:1239 (HEAVY GRADE) OR IS:3589 Gr-A10 AND GALVANISED AS PER IS:4736.
3. ALL COOLING WATER PIPING WILL BE CONFORMING TO IS:1239 (PART-I, HEAVY GRADE).
4. FITTINGS FOR AIR PIPING SHALL BE CONFORMING TO RELEVANT BIS STANDARD AND GRADE EQUIVALENT THAT OF PARENT PIPE GRADE.
5. COMPRESSED AIR PIPING HANDLING HOT AIR WILL BE SUITABLY INSULATED SO AS TO RESTRICT SURFACE TEMPERATURE TO 60 deg C.
6. ALL PRESSURE & TEMPERATURE GAUGE SHALL BE 150 mm DIA. TYPE.
7. DRAIN PIPING UPTO THE NEAREST DRAIN POINT WITHIN THE AIR COMPRESSOR ROOM SHALL BE PROVIDED.
8. THIS PID HAS BEEN PREPARED CONSIDERING ROTARY TYPE AIR DRIERS FOR 1A COMPRESSORS. INCASE OF CONVENTIONAL TWIN TOWER TYPE DRIERS, THIS PID SHALL BE MODIFIED MINORLY.
9. KKS TAG. NO. PHILOSOPHY SHALL BE FOLLOWED & WILL BE INDICATED IN THE VENDOR'S P&ID's.



JOB NO.	411									
STATUS	CONTRACT									
DISTRIBUTION										
TO										
No. of Sheets										
REV.	DATE	ALT.D	CHD		APP					
01	25.06.15	AMG	HK		SK					
REVISED AS PER MOM DATED 25.06.15										

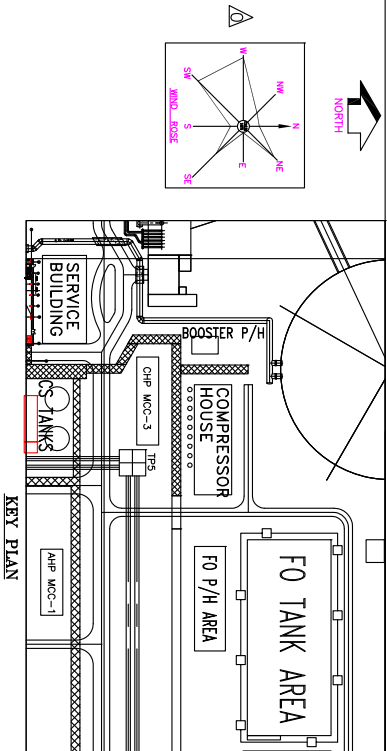
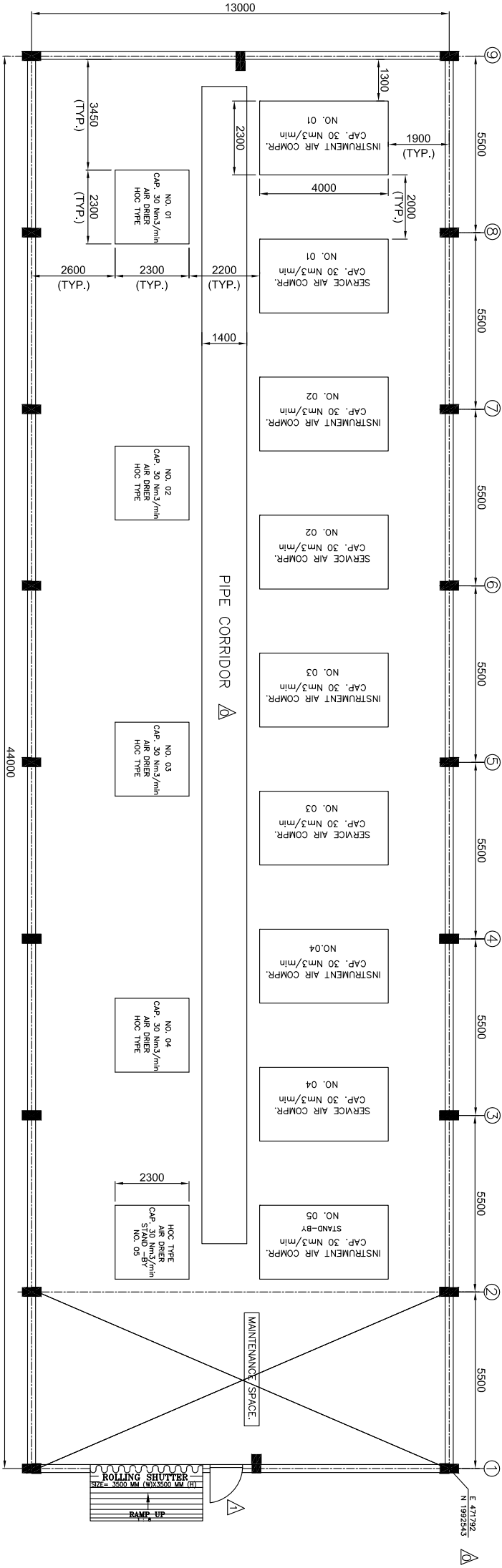
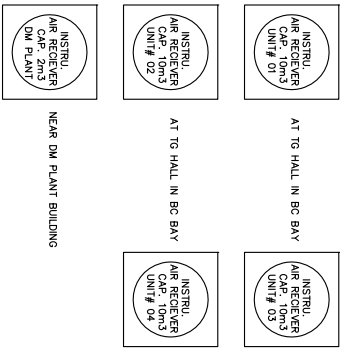
		CUSTOMER		TELANGANA STATE POWER GENERATION CO. LTD.	
		CONSULTANT		DESEIN PRIVATE LTD.	
PROJECT		4X 270MW MANUGURU TPS			
		BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR, PROJECT ENGINEERING MANAGEMENT, NEW DELHI			
TITLE		P & I DIAGRAM FOR COMPRESSED AIR SYSTEM WITH ROTARY DRUM TYPE HOC AIR DRYER			
REVISION		REVISED AS PER MOP DATED 25.06.15			



NO.	DATE	BY	CHK	APPD
01	25.06.15			
02	25.06.15			
03	25.06.15			

NO.	DATE	BY	CHK	APPD
01	25.06.15			
02	25.06.15			
03	25.06.15			

DRAWING NO. PE-DG-114-555-A001



NOTES:-

- 1) ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METERS. EL.(+) 0.000 M CORRESPONDS TO FINISH FLOOR LEVEL OF MAIN PLANT.
- 2) DIMENSION FOR EQUIPMENT LOCATED IN COMPRESSOR HOUSE HAVE BEEN CONSIDERED WORST/MAXIMUM WRT ALL PROSPECTIVE BIDDERS AND WILL NOT CHANGE BUILDING DIMENSIONS AT LATER DATE.
- 3) EQUIPMENT FOUNDATION, PIPING, VALVES AND CABLE SLIT DETAILS SHALL BE INDICATED IN A SEPARATE DRAWING.

REFERENCE DRAWING :-

1) PLOT PLAN PE-DG-411-100-M001

JOB NO.	411									
STATUS	CONTRACT									
DISTRIBUTION										
TO										
No. of Sheets										
REV	DATE	ALTD	CHD	APRD						
01	20.06.15	AND	HK	9/8						
REVISED AS PER MOM DATED 26.06.15.										

CUSTOMER	TELANGANA STATE POWER GENERATION CO. LTD.									
CONSULTANT	DESEIN PRIVATE LTD.									
PROJECT	4X 270MW BHADRADRI TPS									
	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR, PROJECT ENGINEERING MANAGEMENT, NEW DELHI									
	DEPT CODE	DATE	NAME	SIGN		DATE				
	DESIN	PK	PK	SA/-	10.06.2015					
	CHD	HK	HK	SA/-	10.06.2015					
	APPD	PK		SA/-	10.06.2015					
TITLE	COMPRESSOR HOUSE LAYOUT									
DEPT	SCALE	DRAWING No.								
SIGN		PE-DG-411-555-A001								
		SHEET 01	OF 01	REV 01						

NO.	DATE	BY	CHKD	APPD
01	10.06.2015	PK	SK/-	SK/-
02	10.06.2015	PK	SK/-	SK/-
03	10.06.2015	PK	SK/-	SK/-

Annexure-I

IA COMPRESSOR SIZING - 4X270MW BHADRADRI TPP													
				CON/INTER. IA REQUIREMENT				ON / OFF REQUIREMENT					
SL NO	DESCRIPTION	EQPT. PER BLR	CONT (C) / INTER (I)	QTY OF INTER AIR/EQUIPMENT (NM3/OPERATION)	QTY. CONT. PER EQUIP.(NM CUBE PER MIN)	TOTAL QTY CONT.(NM CUBE PER MIN)	TOTAL QTY INTMT.(NM CUBE PER MIN)	QTY. ON / OFF PER EQUIP.(NM CUBE PER MIN)	TOTAL QTY ON / OFF (NM CUBE PER MIN)	START UP IA REQUIREMENT	EMERGENCY IA REQUIREMENT	PRESSURE (KG/SQCM)	REMARKS
A SG & ITS AUXILIARIES FOR ONE UNIT													
1	FD FAN-A BLADE PITCH CONTROL DAMPER	1	C	--	0.09	0.09	--	--	--	--	--	5-7	
2	FD FAN-B BLADE PITCH CONTROL DAMPER	1	C	--	0.09	0.090	--	--	--	--	--	5-7	
3	PA FAN-A BLADE PITCH CONTROL DAMPER	1	C	--	0.09	0.090	--	--	--	--	--	5-7	
4	PA FAN-B BLADE PITCH CONTROL DAMPER	1	C	--	0.09	0.090	--	--	--	--	--	5-7	
5	ID FAN-A INLET CONTROL DAMPER	1	C	--	0.09	0.090	--	--	--	--	--	5-7	
6	ID FAN-B INLET CONTROL DAMPER	1	C	--	0.09	0.090	--	--	--	--	--	5-7	
7	ID FAN-A HYDRAULIC COUPLING SCOOP TUBE POWER CYLINDER	1	C	--	0.09	0.090	--	--	--	--	--	5-7	
8	ID FAN-B HYDRAULIC COUPLING SCOOP TUBE POWER CYLINDER	1	C	--	0.09	0.090	--	--	--	--	--	5-7	
9	GR FAN-A INLET CONTROL DAMPER	1	C	--	0.09	0.09	--	--	--	--	--	5-7	
10	GR FAN-B INLET CONTROL DAMPER	1	C	---	0.09	0.09	--	--	--	--	--	5-7	
11	GR FAN-A HYDRAULIC COUPLING SCOOP TUBE POWER CYLINDER	1	C	---	0.09	0.090	--	--	--	--	--	5-7	
12	GR FAN-B HYDRAULIC COUPLING SCOOP TUBE POWER CYLINDER	1	C	---	0.09	0.09	--	--	--	--	--	5-7	
13	BURNER TILT POWER CYLINDERS	4	C	---	0.23	0.920	--	--	--	--	--	5-7	
14	BURNER TILT POWER CYLINDERS I/P CONVERTER	4	C	---	.006	0.024	--	--	--	--	--	5-7	
15	SEC. AIR DAMPERS ELEV-A	4	C	---	0.004	0.016	--	--	--	--	--	5-7	
16	SEC. AIR DAMPERS ELEV-AB	4	C	---	0.004	0.016	--	--	--	--	--	5-7	
17	SEC. AIR DAMPERS ELEV-B	4	C	---	0.004	0.016	--	--	--	--	--	5-7	
18	SEC. AIR DAMPERS ELEV-BC	4	C	--	0.004	0.016	--	--	--	--	--	5-7	
19	SEC. AIR DAMPERS ELEV-C	4	C	---	0.004	0.016	--	--	--	--	--	5-7	
20	SEC. AIR DAMPERS ELEV-CD	4	C	--	0.004	0.016	--	--	--	--	--	5-7	

SL NO	DESCRIPTION	EQPT. PER BLR	CONT(C) / INTER(I)	QTY OF INTER AIR/EQUIPMENT (NM3/OPERATION)	QTY. CONT. PER EQUIP.(NM CUBE PER MIN)	TOTAL QTY CONT.(NM CUBE PER MIN)	TOTAL QTY INTMT.(NM CUBE PER MIN)	QTY. ON / OFF PER EQUIP.(NM CUBE PER MIN)	TOTAL QTY ON / OFF (NM CUBE PER MIN)	START UP IA REQUIREMENT	EMERGENCY IA REQUIREMENT	PRESSURE (KG/SQCM)	REMARKS
21	SEC. AIR DAMPERS ELEV-D	4	C	--	0.004	0.016	--	--	--	--	--	5-7	
22	SEC. AIR DAMPERS ELEV-DE	4	C	--	0.004	0.016	--	--	--	--	--	5-7	
23	SEC. AIR DAMPERS ELEV-E	4	C	---	0.004	0.016	--	--	--	--	--	5-7	
24	SEC. AIR DAMPERS ELEV-EF	4	C	--	0.004	0.016	--	--	--	--	--	5-7	
25	SEC. AIR DAMPERS ELEV-F	4	C	---	0.004	0.016	--	--	--	--	--	5-7	
26	SEC. AIR DAMPERS ELEV-FF	4	C	--	0.004	0.016	--	--	--	--	--	5-7	
27	SEC. AIR DAMPERS OF A LOWER ELEV	4	C	--	0.004	0.016	--	--	--	--	--	5-7	
28	SEC. AIR DAMPERS OF A UPPER ELEV	4	C	---	0.004	0.016	--	--	--	--	--	5-7	
29	SEC. AIR DAMPERS I/P CONVERTERS	14	C	--	0.006	0.084	--	--	--	--	--	5-7	
30	SCANNER AIR EMERGENCY DAMPER	01	I	0.018	--	--	0.018	--	--	--	--	5-7	
31	SEAL AIR FILTER DP CONTROLLER	01	C	--	0.006	0.006	--	--	--	--	--	5-7	
32	SEAL AIR FILTER POWER CYLINDER	01	C	--	0.003	0.003	--	--	--	--	--	5-7	
33	SEAL AIR TO MILL DISCHARGE VALVE	06	I	0.09	--	--	0.540	--	--	--	--	5-7	
34	SEAL AIR TO MILL	06	I	0.03	--	--	0.180	--	--	--	--	5-7	
35	HOT AIR SHUT OFF GATE	06	I	0.2	--	--	1.200	--	--	--	--	5-7	
36	HOT AIR REGULATING DAMPERS	6	C	--	0.1	0.600	--	--	--	--	--	5-7	
37	COLD AIR REGULATING DAMPERS	6	C	--	0.03	0.180	--	--	--	--	--	5-7	
38	FEEDER OUTLET GATE	6	I	0.019	--	--	0.114	--	--	--	--	5-7	
39	PURGE METERS	12	C	--	0.028	0.336	--	--	--	--	--	5-7	
40	HO PRESSURE CONTROL VALVE	2	C	--	0.01	0.020	--	--	--	--	--	5-7	
41	HO TEMPERATURE CONTROL VALVE	2	C	--	0.01	0.020	--	--	--	--	--	5-7	

SL NO	DESCRIPTION	EQPT. PER BLR	CONT(C) / INTER(I)	QTY OF INTER AIR/EQUIPMENT (NM3/OPERATION)	QTY. CONT. PER EQUIP.(NM CUBE PER MIN)	TOTAL QTY CONT.(NM CUBE PER MIN)	TOTAL QTY INTMT.(NM CUBE PER MIN)	QTY. ON / OFF PER EQUIP.(NM CUBE PER MIN)	TOTAL QTY ON / OFF (NM CUBE PER MIN)	START UP IA REQUIREMENT	EMERGENCY IA REQUIREMENT	PRESSURE (KG/SQCM)	REMARKS
42	LO PRESSURE CONTROL VALVE	2	C	--	0.01	0.020	--	--	--	--	--	5-7	
43	LO TRIP VALVE	1	I	0.01	--	--	0.010	--	--	--	--	5-7	
44	LO FLOW CONTROL VALVE	1	C	--	0.01	0.010	--	--	--	--	--	5-7	
45	HO TRIP VALVE	1	I	0.01	--	--	0.010	--	--	--	--	5-7	
46	HO FLOW CONTROL VALVE	1	C	--	0.01	0.010	--	--	--	--	--	5-7	
47	HO RECIRCULATION LINE TRIP VALVE	1	I	0.01	--	--	0.010	--	--	--	--	5-7	
48	ATOMISING STEAM PR. REDUCING VALVE	1	C	--	0.01	0.010	--	--	--	--	--	5-7	
49	CORNER NOZZLE VALVES	44	I	0.01	--	--	0.440	--	--	--	--	5-7	
50	HEA IGNITER ADVANCE - RETRACT MECHANISM	12	I	0.006	--	--	0.072	--	--	--	--	5-7	
51	SH SPRAY BLOCK VALVES	5	I	0.00837	--	--	0.042	--	--	--	--	5-7	
52	SH SPRAY CONTROL VALVES	4	C	--	0.01805	0.072	--	--	--	--	--	5-7	
53	RH SPRAY BLOCK VALVES	5	I	0.02868	--	--	0.143	--	--	--	--	5-7	
54	RH SPRAY CONTROL VALVES	4	C	--	0.03902	0.156	--	--	--	--	--	5-7	
55	SB STEAM PRV	1	C	--	0.1491	0.149	--	--	--	--	--	5-7	
56	AH DA HEAD VALVES	2	I	0.015	--	--	0.030	--	--	--	--	5-7	
57	LRSB STEAM DRAIN TEMP. CONTROL VALVES	1	I	0.006	--	--	0.006	--	--	--	--	5-7	
58	WB STEAM DRAIN TEMP. CONTROL VALVES - LEFT & RIGHT	2	I	0.006	--	--	0.012	--	--	--	--	5-7	
59	AHSB STEAM DRAIN TEMP. CONTROL VALVE	1	I	0.006	--	--	0.006	--	--	--	--	5-7	
60	SPARE	5	C	--	0.5	2.500	--	--	--	--	--	5-7	

B TG & ITS AUXILIARIES FOR ONE UNIT

61	PNEUMATIC ACTUATOR FOR BFP RECIRCULATION VALVE		C	--	--	0.033	--	--	--	--	--	3	
62	FLUE GAS ANALYZER	1	C	--	0.01	0.010	--	0.02	0.020	--	--	5-7	
63	CONTINUOUS PURGING OF TRANSMITTER IMPULSE LINES (INSTRUMENT AIR)	35	C	--	0.025	0.875	--	--	--	--	--	5-7	

SL NO	DESCRIPTION	EQPT. PER BLR	CONT(C) / INTER(I)	QTY OF INTER AIR/EQUIPMENT (NM3/OPERATION)	QTY. CONT. PER EQUIP.(NM CUBE PER MIN)	TOTAL QTY CONT.(NM CUBE PER MIN)	TOTAL QTY INTMT.(NM CUBE PER MIN)	QTY. ON / OFF PER EQUIP.(NM CUBE PER MIN)	TOTAL QTY ON / OFF (NM CUBE PER MIN)	START UP IA REQUIREMENT	EMERGENCY IA REQUIREMENT	PRESSURE (KG/SQCM)	REMARKS
64	INTERMITTENT PURGING OF TRANSMITTER IMPULSE LINES (INSTRUMENT AIR)	35	--	--	--	0.085	--	0.025	0.875	--	--	5-7	
65	E/P CONVERTER	50	C	--	0.015	0.750	--	--	--	--	--	5-7	
66	REFERENCE AIR OF OXYGEN ANALYSER	8	C	--	0.0015	0.012	--	--	--	--	--	5-7	
67	CO ANALYZER	4	C	--	0.06	0.240	--	--	--	--	--	5-7	
68	DUST ANALYZER	4	C	--	0.06	0.240	--	--	--	--	--	5-7	
69	MERCURY ANALYZER	1	C	--	0.28	0.280	--	--	--	--	--	5-7	
70	PNEUMATIC ACTUATOR FOR GLAND STEAM SUPPLY VALVE	1	C	--	0.04	0.040	--	--	--	--	--	5-7	
71	PNEUMATIC ACTUATOR FOR GLAND STEAM LEAK OFF VALVE	1	C	--	0.52	0.520	--	--	--	--	--	5-7	
72	PNEUMATIC ACTUATOR FOR VACCUM BREAKER VALVE	1	C	--	0.36	0.360	--	--	--	--	--	5-7	
73	PNEUMATIC ACTUATOR FOR WATER INJECTION VALVE	1	C	--	0.3	0.300	--	--	--	--	--	5-7	
C	FOR OTHER PLANTS & BUILDING												
74	IA REQUIREMENT FOR OTHER PLANTS		C			0.50							

Total

10.67

2.83

a	Total Continuous Requirement/ unit =	10.67	Nm3/min	
b	Total Intermittent Requirement/ unit =	2.83	Nm3/min	
c	Total IA requirement/unit =	11.80	Nm3/min	Total Instrument Air Required per Unit = Total Continuous requirement + 40% of Intermittent Requirement
d	Capacity of each IA Compressor =	30	Nm3/min	

SA COMPRESSOR SIZING - 4X270MW BHADARDRI TPP

S.No.	Description of Equipment	No. off Equip. / Boiler	Cont. / Intermittent. / start up / emergency	QTY per equipment, Nm3/min	Total QTY NM3/min (Cont.)	Total QTY NM3/min (Intt.)	Total QTY NM3/min (startup)	Total QTY NM3/min (emer.)	Pressure (Kg/cm2)	Remark
SERVICE AIR COMPRESSOR-SIZING CALCULATION										
A	FOR SG & IT'S AUXILIARIES for one unit									
1	ATOMISING AIR FOR LDO FIRING	4	startup	2.80			11.2		7.0	
	PULVERISED COAL SAMPLING / PIPE	2	intermittent	0.58		1.2			7.0	2 Nos. Pulverised coal samplers per pipe, Intermittent, 2 samplers at a time.
2	HEA IGNITOR PURGING	12	Continuous	0.45	5.4				7.0	
3	FEEDER BULL'S EYE OPENING	6	intermittent	0.02		0.1			7.0	
4	REGENERATIVE AIR MOTOR	2	Emergency	8.00				16.00	7.0	Emergency air requirement for tri-sector air motor are required in case of failure of AC motor for tri-sector air heater equipment. Accordingly these requirements are not considered in sizing.
5	REGENERATIVE AH SOOT BLOWER	4	startup	10.67			10.67		7.0	Start up requirement for tri-sector air heater soot blowing are required before initiation of coal firing, at this time atomised air for LDO firing will not be required. Further soot blowing is done with one air heater at a time.
	TOTAL				5.40	1.28	21.87	16.00		
B	For TG & It's Auxiliaries for one unit		Continuous		1.50					
C	For other plant buildings/ facilities		Continuous		0.50					
D	Capacity of SA compressor for one unit									
a	Continuous Air requirement		7.40	NM3/min	(5.4+1.5+0.5)					
b	Intermittent Air requirement		1.28	NM3/min	Diversity factor of 0.4 is considered for intermittent requirements.					
c	Continuous (including intermittent air requirement)		7.91	NM3/min	c = a + 0.4 x b					

S.No.	Description of Equipment	No. off Equip. / Boiler	Cont. / Intermittent. / start up / emergency	QTY per equipment, Nm3/min	Total QTY NM3/min (Cont.)	Total QTY NM3/min (Intt.)	Total QTY NM3/min (startup)	Total QTY NM3/min (emer.)	Pressure (Kg/cm2)	Remark
d	Wear & Tear margin, 10% of c		0.79							
e	Leakage Margin, 10% of c		0.79							
f	Total continuous SA including margin		9.49		f = c + d + e					
E	Hence, Capacity of SA Compressor selected		30.00	NM3/min						

PROJECT: 4X270MW BHADRADRI TPP
PACKAGE: COMPRESSED AIR SYSTEM

AIR RECEIVER SIZING CALCULATION

As per cl. no. 5.1 of IS: 7938, air receiver capacity shall be one-tenth of the free air delivery per minute of compressor.

The calculations are as below:

- a) FAD of compressor= 37.7 m³/minute
- b) Capacity of air receiver arrived = 3.77 m³

As per IS: 7938, in the case of rotary compressors, a receiver of this capacity (3.77 m³) shall be in addition to the receiver forming part of the compressor design.

- c) Total capacity arrived = 2*3.77=7.54 m³

- d) Hence, air receiver Capacity selected per compressor= 10 m³



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COMPRESSED AIR SYSTEM
4X270 MW BHADRADRI TPS**

SPECIFICATION NO.

SECTION : **IB**

REV NO. : **00** DATE : 30/03/17

SHEET : 1 OF 3

SECTION-IB

**TECHNICAL SPECIFICATION FOR
COMPRESSED AIR SYSTEM
(ELECTRICAL PORTION)**



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COMPRESSED AIR SYSTEM
4X270 MW BHADRADRI TPS**

SPECIFICATION NO.

SECTION : **IB**

REV NO. : **00** DATE : 30/03/17

SHEET : 2 OF 3

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

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

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COMPRESSED AIR SYSTEM
4X270 MW BHADRADRI TPS**

SPECIFICATION NO.

SECTION : **IB**

REV NO. : **00** DATE : 30/03/17

SHEET : 3 OF 3

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

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) General technical requirements for LV motors.
- c) Datasheet A & C.
- d) Quality plan for motors.
- e) Electrical Load data format (Annexure –II)
- f) BHEL cable listing format (Annexure –III)

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGES : COMPRESSED AIR SYSTEM****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 4 x 270 MW BHADRADRI TPP**

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	6.6 KV / 415 V Switchgear	BHEL	BHEL	415 V AC (3 ph 4 wire)/240 V AC (supply feeder) shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motors.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system. 100/50 mm cable trays/Conduits/Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs as per approved layout drawing during contract stage.
7	Cable glands, lugs & bimetallic strip for equipments supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power & control cables.
8	Conduit and conduit accessories for cabling between equipments supplied by vendor.	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	--
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	--
12	Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGES : COMPRESSED AIR SYSTEM****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 4 x 270 MW BHADRADRI TPP**

15	Any other equipment/material/service required for completeness of system based on the system offered by vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	--
16	a. Input cable schedules (C & I) b. Cable interconnection detail for the above c. Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Cabling layout drawings	BHEL/ Vendor	-	a. In case of Compressor are HT motors, cable tray/trench layout inside compressed air building shall be prepared by BHEL. Vendor to furnish drawing (both in print form as well as in AUTOCAD) of compressor room layout clearly indicating all motors, panels, JB's etc. which require cabling alongwith their terminal box/location/ Foundation etc. b. In case of Compressor are LT motors, for ensuring cabling requirements are met, vendor shall prepare & submit cable tray/trench & equipment layout (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling for BHEL review & approval.
18	Electrical equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

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

SL.NO.	PARAMETERS	REQUIREMENTS
1	CODE ANS STANDARDS	IS-325, IS-12615, IEC-60034
2	SERVICE CONDITIONS	Hot, Humid and Tropical Atmosphere highly polluted.
3	TYPE AND RATING	General purpose, Constant speed, Squirrel cage, Three/Single phase, Induction type, Continuous duty, motor name-plate rating at 50°C shall have at least 15% margin
4	EFFICIENCY CLASS	IE3 (As per latest BIS notification)
5	RUNNING REQUIREMENT	(a) Motor shall run continuously at rated output over the entire range of 415V±10% voltage and 50Hz+3% to -5% frequency variations. (b) The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals. (c) The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.
6	STARTING CURRENT	(a) Motor shall be designed for direct online starting at full voltage. Breakaway starting current as percentage of full load current for various motor rating shall not exceed 600% subject to IS tolerance of plus 20%. (b) The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage. (c) Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals. (d) Two hot starts in succession with motor initially at normal running temperature. (e) The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage.
7	LOCKED ROTOR WITHSTAND TIME	(a) Under hot condition at 110% rated voltage shall be more than motor starting time by at least 3 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time at minimum permissible voltage of 80% rated voltage. (b) Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.
8	ENCLOSURE	All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy.
9	COOLING	The motor shall be self ventilated type, either totally enclosed fan cooled IC 411(TEFC), totally enclosed tube ventilated IC 511(TETV) or closed air circuit air-cooled IC 611(CACA).
10	WINDING AND INSULATION	(a) All insulated winding shall be of copper. (b) Class F insulation but limited to class B temperature rise. (c) Windings shall be impregnated to make them non-hygroscopic and oil resistant.
11	TROPICAL PROTECTION	(a) All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion. (b) All fittings and hardwares shall be corrosion resistant.

12	SPACE HEATERS	All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
13	BEARINGS	(a) Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be rated for minimum service life of 40,000Hrs. (b) Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. (c) Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area. (d) Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication. LT motors 15kW and above shall be provided with external greasing arrangement. (e) Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.
14	MOTOR TERMINAL BOX	(a) Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. (b) Terminal box shall be capable of being turned 360 Deg. in steps of 90 degree for LV motors unless otherwise approved. (c) The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor. (d) Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame (e) The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor. (f) The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec. (g) Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used. (h) Degree of protection for terminal boxes shall be IP 55 as per IS 4691. (i) unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end. (j) Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.
15	MINIMUM PHASE TO PHASE & PHASE TO EARTH CLEARANCE FOR 415V	25 mm
16	GROUNDING	(a) The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer to accommodate Flat ground conductor (as defined in Datasheet A). (b) The cable terminal box shall have a separate grounding pad.
17	RATING PLATE	In addition to the minimum information required by IS, the following information shall be shown on motor rating plate : (a) Temperature rise in Deg.C under rated condition and method of measurement. (b) Degree of protection.

		(c) Bearing identification no. and recommended lubricant.
18	DRAIN PLUG	Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.
19	LIFTING PROVISIONS	Motor weighing 20 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.
20	PAINTING	Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions subject to Customer's approval during detailed engineering.
21	TESTS	All motors shall be subjected to Type tests & routine tests as per IS: 325 and approved quality plan.
22	DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT	DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes. c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet). i) Current vs. time at rated voltage and minimum starting voltage. ii) Speed vs. time at rated voltage and minimum starting voltage. iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling. iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

DATA SHEET A

SL.NO.	PARAMETERS	4X270MW BHADRADRI
1	Design ambient temperature	50 °C
2	Maximum acceptable kW rating of LV motor	160KW *
3	Installation (Indoors/ Outdoors)	As required
4	Degree Of protection for motor/ terminal box	IP 54/ IP 55
5	Type of Cooling	TEFC/CACA/TETV
6	Details of supply system	
a)	Rated voltage (with variation)	415V $\pm$ 10%
b)	Rated frequency (with variation)	50 Hz + 3 % to - 5%
c)	Combined voltage & freq. variation	10% (sum of absolute values)
d)	System fault level at rated voltage	50 kA for 1 sec
e)	Short time rating for terminal boxes	
i)	110 kW and above (Breaker Controlled)	50 KA for 0.25 sec..
ii)	Below 110 Kw (Contactor Controlled)	50 KA protected by HRC fuse
f)	LV System grounding	Solidly
7	Class of insulation	Class 'F', with temp rise limited to class B.
8	Minimum voltage for starting (As percentage of rated voltage)	(a) 85% below 110KW (b) 80% from 110KW to 160KW (c) 85% above 160KW to 1000KW (d) 80% from 1001 KW to 4000KW (e) 75% > 4000KW
9	Power cables data	Shall be given during detailed engg.
10	Earth Conductor Size & Material	415 V motors : Above 90 kW - 50 x 6 Galvanised MS Flat 415 V motors : Above 30 upto 90 kW - 35 x 6 Galvanised MS Flat 415 V motors : Above 2.2 upto 90 kW - 25 x 3 Galvanised MS Flat 415 V motors : Upto 2.2 kW - 8SWG GI/GS Wire
11	Space heater supply	240 V, 1 ϕ , 50 Hz (for motors above 30 Kw)
12	Rating up to which Single phase motor	Acceptable below 0.20 kW
13	Locked rotor current Limit as percentage of FLC	As per IS 12615*
14	Flame-proof motor	
a)	Enclosure suitable (As per IS: 2148)	As per requirement
b)	Classification of Hazardous area (As per IS: 5572 part-I)	As per requirement
15	Makes	BHEL/ Customer approval
16	Paint shade	Shall be given during detailed engg
17	TESTING	All motors shall be subjected to Type tests & routine tests as per IS: 325 and approved quality plan.
18	Energy efficient motors	* Continuous duty LT motors up to 160 KW Output rating (at 50 deg.C ambient temperature), shall be premium efficiency (IE3) as per IEC: 60034-30/ IS:12615.

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE		SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE			
		SHEET 1 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
				BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE		
		SHEET 2 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 3 OF 9		CUSTOMER :		PROJECT			SPECIFICATION :			
				BIDDER/		TITLE			NUMBER :			
				VENDOR		QUALITY PLAN			SPECIFICATION :			
				SYSTEM		NUMBER PED-506-00-Q-007, REV-03			TITLE			
						ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA MA	VISUAL TEST	100% SAMPLE	- MANUF'S SPEC.	NO VISUAL DEFECTS MANUF'S SPEC.	INSPT. REPORT LOG BOOK AND OR SUPPLIER'S TC	3 3	- -	2 2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2.DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA MA MA	VISUAL MEASUREMENT ELECT. & MECH TESTS	100% SAMPLE -DO-	- MANUFR'S DRG. . MANUF'S SPEC./ RELEVANT IS	NO VISUAL DEFECTS (FREE FROM BURS) MANUFR'S DRG. RELEVANT IS	LOG BOOK -DO- SUPPLIER'S TC	3 3 3	- - -	- 2 2	
1.9	CONDUCTORS	1. SURFACE FINISH 2.ELECT. PROP. & MECH. PROP	MA MA	VISUAL ELECT. & MECH.TEST	100% SAMPLES	- RELEVANT IS/ BS OR OTHER STANDARDS	FREE FROM VISUAL DEFECTS RELEVANT IS/ BS OR OTHER STANDARDS	LOG BOOK SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3* 3	- -	2* 2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 4 OF 9		CUSTOMER :		PROJECT			SPECIFICATION :			
				BIDDER/		TITLE			NUMBER :			
				VENDOR		QUALITY PLAN			SPECIFICATION :			
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			TITLE			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION VOLUME III			
									P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
				BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE		
		SHEET 5 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNES	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC./BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :			PROJECT		SPECIFICATION :			
				BIDDER/ :			TITLE		NUMBER :			
				VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE			
SHEET 6 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	FOR MV MOTOR
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	THREE DIPS TO BE GIVEN
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 7 OF 9		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	VERIFICATION FOR MV MOTOR ONLY
		1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 8 OF 9		CUSTOMER :		PROJECT			SPECIFICATION :				
				BIDDER/ :		TITLE			NUMBER :				
				VENDOR		QUALITY PLAN			SPECIFICATION :				
		SYSTEM		NUMBER PED-506-00-Q-007, REV-03			TITLE						
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			11	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1	
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^s	1	^s NOTE - 2	
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 ^s	1	^s NOTE - 2	
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-		
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3	
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^s	1	^s NOTE - 2	
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^s	1	^s NOTE - 2	
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 ^s	1	^s NOTE - 2	
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3	
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^s	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY ^s NOTE - 2	
BHEL			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN SHEET 9 OF 9		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
										BIDDER'S/VENDORS COMPANY SEAL		

		QUALITY PLAN	CUSTOMER :			PROJECT			SPECIFICATION :				
			BIDDER/ : VENDOR			TITLE QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			NUMBER :				
									SPECIFICATION TITLE				
SHEET 1 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION		VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	P	W	V		
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-		
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-		
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-		
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-		
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1			NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-		NOTE -1 & NOTE-3
BHEL			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
		SHEET 2 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS		BIDDER/VENDOR				BIDDER'S/VENDORS COMPANY SEAL			
			NAME									
			SIGNATURE									
			DATE									

ANNEXURE III

[illegible]

	TITLE	MOTOR DATA SHEET – C 4 X 270 MW BHADRADRI TPS	SPECIFICATION NO.	
			SECTION IB	
			REV NO. 00 DATE	
			SHEET 1 OF 2	

S. No.	Description		Data to be filled by successful bidder
A.	General		
1	Manufacturer & country of origin		
2	Motor type		
3	Type of starting		
4	Name of the equipment driven by motor & Quantity		
5	Maximum Power requirement of driven equipment		
6	Rated speed of Driven Equipment		
7	Design ambient temperature		
B.	Design and Performance Data		
1	Frame size & type designation		
2	Type of duty		
3	Rated Voltage		
4	Permissible variation for		
5	a	Voltage	
6	b	Frequency	
7	c)	Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)		
9	Synchronous speed & Rated slip		
10	Minimum permissible starting voltage		
11	Starting time in sec with mechanism coupled		
12	a) At rated voltage		
13	b) At min starting voltage		
14	Locked rotor current as percentage of FLC (including IS tolerance)		
15	Torque		
	a) Starting		
	b) Maximum		
16	Permissible temp rise at rated output over ambient temp & method		
17	Noise level at 1.0 m (dB		
18	Amplitude of vibration		
19	Efficiency & P.F. at rated voltage & frequency		
	a) At 100% load		
	c) At 75% load		

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	MOTOR DATA SHEET – C 4 X 270 MW BHADRADRI TPS	SPECIFICATION NO.	
			SECTION IB	
			REV NO. 00 DATE	
			SHEET 2 OF 2	

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			



Technical specification for
Compressed Air System

4 X 270 MW BHADRADRI TPP, TELANGANA

REV. NO. 00 DATE : 24.03.2015

SECTION-IC

**C&I SPECIFICATION FOR
COMPRESSED AIR SYSTEM**



Technical specification for
Compressed Air System

4 X 270 MW BHADRADRI TPP, TELANGANA

REV. NO. 00 DATE : 24.03.2015

Table of Contents

Sheet No.

1.1	Specific Technical Requirement.....	3
1.1	Actuator Specification.....	7
1.2	Actuator Datasheet.....	13
1.3	Drive Control Philosophy.....	18
1.4	Instrumentation Datasheets.....	24
1.5	Instrumentation Check Lists.....	55
1.6	LCP & Junction Boxes Specification.....	61
1.7	LCP Quality Plan.....	76
1.8	Erection Hardware.....	84
1.9	Applicable Cable Types.....	94
1.10	Applicable Codes & Standards.....	96
1.11	KKS Philosophy.....	101



Technical specification for
Compressed Air System

4 X 270 MW BHADRADRI TPP, TELANGANA

SECTION C

REV. NO.

00

DATE : 24.03.2015

SECTION-IC

SPECIFIC TECHNICAL REQUIREMENT