

## MV MOTORS

VOLUME IIB

SECTION D

SHEET 11

OF 11

65.0 List of Spares

Commissioning Spares

O&amp;M Spares

Name of vendor

Project

Revision number

0

1


2

3

Vendor's signature


**SPECIFIC ELECTRICAL REQUIREMENT FOR MILL REJECT HANDLING SYSTEM**

SL.NO.	PARAMETERS	UNIT	LT MOTORS	HT MOTORS
	<b>MOTOR</b>			
1	DESIGN AMBIENT TEMP	DEG. C	50	50
2	VOLTAGE SUPPLY AND VARIATION	KVOLT	0.415± 10%	11/3.3± 10%
3	FREQUENCY WITH VARIATION	Hz	50± 5%	50± 5%
4	COMBINED VOLTAGE & FREQUENCY VARIATION (sum of absolute values)		10%	10%
5	MAX ACCEPTABLE RATING OF MOTOR	KW	AT 415 V 160 KW & below	AT 3.3 KV 160 KW upto & including 1499 KW AT 11 KV 1500 KW & above
6	SYSTEM FAULT LEVEL AND ITS DURATION	KA	50kA, 1sec	50kA, 3sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.25 sec	50 KA, 0.25 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F and temp rise limited to Class-B	Class-F and temp rise limited to Class-B
9	MIN. STARTING VOLTAGE		80%	80%
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.2 kW & Below	--
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	600% subject to 20% tol.	600% inclusive of IS tol.
12	ACCEPTABLE NOISE LEVEL	DB	Noise level for all motors shall be limited to 85dB(A) at 1.5 m	Noise level for all motors shall be limited to 85dB(A) at 1 m
13	TYPE OF STARTER PROVIDED IN MCC		DOL	DOL
14	DOP OF ENCLOSURE		IP-55 & IP-54 for outdoor & indoor resp.	IP-55 & IP-54 for outdoor & indoor resp.
15	SPACE HEATER REQUIREMENT	<30kW	30KW & ABOVE	YES
16	PAINT SHADE		during detailed engineering	during detailed engineering
17	SPECIAL REQUIREMENT		MOTORS ARE ENERGY EFFICIENT (TYPE EFF 1) AS PER IS :12615.	MOTORS ARE ENERGY EFFICIENT (TYPE EFF 1) AS PER IS :12615.

	TITLE	SPECIFICATION NO.
	MOTOR	VOLUME II B
	DATA SHEET - C	SECTION D
	2 x 800 MW Yeramarus, Karnataka	REV NO. 00 DATE 29/08/2005
		SHEET 1 OF 2

S. No.	Description		Data to be filled by successful bidder
A.	<b>General</b>		
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.	<b>Design and Performance Data</b>		
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			


	<b>TITLE</b>  <b>MOTOR</b>  <b>DATA SHEET - C</b> <b>2 x 800 MW Yeramarus, Karnataka</b>	<b>SPECIFICATION NO.</b>	
		<b>VOLUME</b>	<b>II B</b>
		<b>SECTION D</b>	
		<b>REV NO. 00 DATE 29/08/2005</b>	
		<b>SHEET</b>	<b>2 OF 2</b>


S. No.	Description	Data to be filled by successful bidder
	c) At starting	
<b>C.</b>	<b>Constructional Features</b>	
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)	
<b>D.</b>	<b>Characteristic curves/ drawings</b> (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			




		QUALITY PLAN		CUSTOMER :				PROJECT		SPECIFICATION :							
				BIDDER/ : VENDOR SYSTEM				TITLE		NUMBER :		SPECIFICATION		TITLE			
																SPECIFICATION	
																TITLE	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	P	W	V	REMARKS				
1	2	3	4	5	6	7	8	9	10	11							
1.0	ASSEMBLY	1.WORKMANSHIP 2.DIMENSIONS 3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-						
			MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-						
			MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC./ RELEVANT IS	-DO-	2	-	-						
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUF'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. 2.OVERALL DIMENSIONS & ORIENTATION	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1			NOTE -1 & NOTE-3				
			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/ :		QUALITY PLAN		SPECIFICATION : TITLE :		
	SHEET 2 OF 2		SYSTEM		NUMBER PED-506-00-Q-006, REV-01		VOLUME III		
	SL. NO.	COMPONENT/OPERATION CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY P W V REMARKS
1	2	3	4	5	6	7	8	9 10 11	
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2 1 -
<p>NOTES:</p> <p>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 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION. (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p> <p>2 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.</p> <p>3</p> <p><u>Legends for Inspection agency</u></p> <p>1. BHEL/CUSTOMER</p> <p>2. VENDOR (MOTOR MANUFACTURER)</p> <p>3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)</p> <p>P. PERFORM</p> <p>W. WITNESS</p> <p>V. VERIFY</p>									
BHEL		PARTICULARS		BIDDER/VENDOR					
		NAME							
		SIGNATURE							
		DATE							
BIDDER'S/VENDORS COMPANY SEAL									

<div></div>		CUSTOMER :		PROJECT		SPECIFICATION :						
		QUALITY PLAN		TITLE		NUMBER :						
				QUALITY PLAN		SPECIFICATION :						
				NUMBER PED-506-00-Q-007, REV-03		TITLE						
COMPONENT/OPERATION		CHARACTERISTIC CHECK		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.				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		
1.0	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	MANFR'S DRG./SPEC	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	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUF'R'S DRG.	MANUF'R'S DRG.	MANUF'R'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	MANFR'S DRG./SPEC	LOG BOOK	3	-	2
												HEAT NO. SHALL BE VERIFIED
BHEL		PARTICULARS		BIDDER/VENDOR								
		NAME										
		SIGNATURE										
		DATE										
				BIDDER/SVENDORS COMPANY SEAL								

<div></div>		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :													
				BIDDER/ : VENDOR		TITLE		NUMBER :													
								SPECIFICATION :													
								TITLE													
SHEET 2 OF 9		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III											
COMPONENT/OPERATION		CHARACTERISTIC CHECK		CAT. SYSTEM		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-	MANUF'R'S DRG.	LOG BOOK	3	-	2										
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUF'R'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE									
1.6	SPACE HEATERS, CONNEC- TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUF'R'S DRG. SPEC.	MANUF'R'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	MANUF'R'S DRG./ SPEC.	MANUF'R'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			CUSTOMER :			PROJECT		SPECIFICATION :				
SHEET 3 OF 9			BIDDER/ :			TITLE		NUMBER :				
			SYSTEM			QUALITY PLAN		SPECIFICATION :				
CHARACTERISTIC CHECK			CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	VOLUME III		
SL. NO.	COMPONENT/OPERATION	3	4	5	6	7	8	9	P	W	V	REMARKS
1	2	11								10		11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.  2. OTHER CHARACTERISTICS	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.  2.DIMENSIONS INCLUDING BURS HEIGHT  3. ACCEPTANCE TESTS	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH  2.ELECT. PROP. & MECH. PROP	MA	ELECT. & MECH. TEST	SAMPLES	RELEVANT IS/BS OR OTHER STANDARDS	RELEVANT IS/BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	
FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT												
* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.												
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
BIDDER'S/VENDORS COMPANY SEAL												


		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION :			
		SHEET 4 OF 9		BIDDER/ : VENDOR		QUALITY PLAN		NUMBER :			
		COMPONENT/OPERATION		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		TITLE			
		SL. NO.	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	VOLUME III REMARKS
1	2	3	4	5	6	7	8	9	10	11	
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	MANFR'S DRG./ APPROVED DATASHEET	-DO-	Log Book	3	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	-DO-	-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/ VENDORS COMPANY SEAL	


<div></div>		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :				
				BIDDER/ VENDOR		TITLE		NUMBER :				
SHEET 5 OF 9		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		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	
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR )	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ASTM-E165	MANUF'S SPEC./BHEL SPEC./	-DO-	2	-	1	
		1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC./BHEL SPEC./RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
2.3	PAINTING	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/ VENDORS COMPANY SEAL						





CUSTOMER :				PROJECT		SPECIFICATION :															
QUALITY PLAN				TITLE		NUMBER :															
BIDDER/ VENDOR				QUALITY PLAN		SPECIFICATION :															
SYSTEM				NUMBER PED-506-00-Q-007, REV-03		TITLE															
SHEET 7 OF 9				ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		VOLUME III															
SL. NO.		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	

<div></div>		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :					
				BIDDER/ VENDOR SYSTEM		TITLE		NUMBER :		SPECIFICATION :			
SHEET 8 OF 9													
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS	VOLUME III		
1	2	3	4	5	6	7	8	9	P	W	V		
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC. 2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC. 3.VIBRATION & NOISE LEVEL 4.OVERALL DIMENSIONS AND ORIENTATION 5.DEGREE OF PROTECTION 6. MEASUREMENT OF RESISTANCE OF RTD & BTD 7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER 8. NAMEPLATE DETAILS 9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED) 10. PAINT SHADE, THICKNESS & FINISH	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	
			MA	-DO-	100%	-DO-	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-		
			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
			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	1	\$ NOTE - 2
			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	1	\$ NOTE - 2
			MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1\$	1	1	\$ NOTE - 2
			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
			MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1\$	1	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2
BHEL													
			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE										
BIDDER/ VENDORS COMPANY SEAL													

		<b>QUALITY PLAN</b>		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :																	
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE																	
SHEET 9 OF 9		SYSTEM		CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)															
COMPONENT/OPERATION		CHARACTERISTIC CHECK								SECTION AGENCY															
										P W V															
1		2		3		4		5		6															
										7															
										8															
										9															
										10															
										11															
<p>NOTES:</p> <p>1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.</p> <p>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.</p> <p>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.</p> <p>4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p> <p><u>Legends for Inspection agency</u></p> <p>1. BHEL/CUSTOMER  2. VENDOR (MOTOR MANUFACTURER)  3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)</p> <p>P. PERFORM  W. WITNESS  V. VERIFY</p>																									
<table border="1"> <tr> <td rowspan="4">BHEL</td> <td colspan="2">PARTICULARS</td> <td rowspan="4">BIDDER/VENDOR</td> </tr> <tr> <td colspan="2">NAME</td> </tr> <tr> <td colspan="2">SIGNATURE</td> </tr> <tr> <td colspan="2">DATE</td> </tr> <tr> <td colspan="4">BIDDER'S/VENDORS COMPANY SEAL</td> </tr> </table>												BHEL	PARTICULARS		BIDDER/VENDOR	NAME		SIGNATURE		DATE		BIDDER'S/VENDORS COMPANY SEAL			
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TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X800 MW YERAMARUS TPS, KARNATAKA**

BHEL DOCUMENTS NO.: PE-TS-31 I -160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

**VOLUME – II B**


**SECTION – C3**


**SPECIFIC TECHNICAL REQUIREMENTS**

**CONTROL AND INSTRUMENTATION SPECIFICATION**


### **Specific Technical Requirements (C&I):**

- 1.1 **MILL REJECT SYSTEM** shall be controlled from DCS (BHEL scope of supply).
- 1.2 Bidder to supply the field instrumentation as required / shown in the P&ID.
- 1.3 The detailed specification of instruments, JB, control panel are given in detail as below.
- 1.4 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- 1.5 Drawings/Documents and data to be furnished after award of the contract:
  - Field instruments data sheet.
  - JB grouping document.
  - Cable schedule and cable interconnection drawing.
  - Instrument schedule.
  - Drive List and Analog / Binary Input / output List
  - Recommended Control write-up
  - Any other document decided during detailed engineering.

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<p><b>1.00.00</b></p>	<p><b><u>Technical Specifications for Field instruments:</u></b></p> <p>All instruments offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven as mentioned in design criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance. They shall comply with the acceptable international standards and shall be subject to Employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications.</p> <p>The Contractor shall furnish all Instrumentation/ Control equipment &amp; accessories under this specification as per technical specification, ranges, makes &amp; models approved by the Employer during detailed engineering. The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/ erection of these transmitters shall be furnished, even if not specifically asked for, on as required basis. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.</p> <p><b>2.00.00 <u>Smart Electronic Transmitters for Measurement of Pressure, Differential Pressure(DP) &amp; Flow/Level(DP Type):</u></b></p> <p>2.00.01 Micro-processor based indicating type (LCD display), rack mounted with accuracy of +/- 0.1% of span, Repeatability : +0.05% of FSR or better, Linearity :+0.1% of FSR or better. Hysteresis: +0.1% of FSR or better. external zero and span adjustment, self diagnostics, temperature sensor for compensation. Power supply 24 V DC; output signal of 4- 20 mA DC. IP 65 or equivalent degree of protection with epoxy coating, 316 SS/ Hastelloy/ other suitable sensing element. Accessories like snubbers for pump discharge applications and chemical diaphragm with 15 m PVC covered SS armoured capillary for corrosive and oil services, etc. Material for accessories will be SS. HART protocol output shall be available in each transmitter. In case it becomes necessary to use a DP transmitter for pressure measurement then a 3-valve manifold should be used in place of 2-valve manifold. LVDT type is not acceptable.</p> <p>2.00.02 Wherever, the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.</p> <p>2.00.03 <u>In Detail Technical Specification:</u> 1) Type of Transmitter: Microprocessor based 2 wire type HART protocol compatible,</p>	


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	<p>TITLE <b>SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC</b></p> <p>2) Accuracy : - +/- 0.1 % of span  3) Output Signal Range: 4-20 mA D C (Analog) <i>Superimposed digital on HART protocol</i>  4) Turn Down Ratio : 10:1 for vacuum/very low pressure applications  30:1/100:1 for other applications  5) Stability: +/-0.1% of calibrated span for 6 months up to 70 KSC &amp;    6) Zero and Span Drift: +/- 0.015% per Deg.C at max. span and 0.11% per Deg.C at Minimum Span  7) Load Impedance: 500 ohm (Min)  8) Housing: Weather proof as per IP-65 with durable corrosion resistant coating  9) Over Pressure - 150 % of Max. operating pressure  10) Connection (Electrical)- Plug and socket type  11) Process Connection - 1/2 inch NPT (F)  12) Span and Zero: Continuous, tamper proof, Remote Adjustability as well as manual from instrument with zero suppression and elevation facility.  13) Accessories a) Diaphragm seal, pulsation dampeners syphon etc. as required by service and operating condition.  b) 2/3/5 Valve manifold as applicable  14) Diagnostics: Self Indicating Feature  15) Power Supply: 24 V DC +/- 10%  16) Adjustment : Calibration facility via Centralized PC based HART management system.</p> <p><b>3.00.00      <u>Displacement Type Level Transmitters:</u></b></p> <p>Displacement/DP Type Smart Electronic Level Transmitters shall be provided for level measurement of condenser hotwell level, LP Heaters, HP Heaters and other vacuum services, shall be considered by the Contractor. If any more transmitters over and above the quantity indicated are required for the safe and efficient operation and maintenance the same shall be included. The type/ranges/make of transmitters and services for which these transmitters are required shall be as decided and approved by the owner during detailed engineering.</p> <p>Microprocessor based smart type, displacement type level transmitters of float length of 14 inches or 32 inches with an accuracy of +/-0.5% of span, 4-20 mA DC output (2 wire system), +24 V DC supply, isolated and ungrounded electrical circuits, zero adjustment (100% of sensing element) for control application and measurement purposes for all services of condensate and drains, particularly where two phases of steam and water are present. IP 65 or equivalent degree of protection for enclosure. Displacer/float material of 316SS. The material of accessories will be SS.</p>	<p>SHEET 2 OF 10</p>



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4.00.00	<p><b><u>Thermocouple Assembly with Thermowell</u></b></p> <p>Duplex type with accuracy of +/-0.5% of span (as per IEC-584 class-I for turbine applications) response time of 2 to 6 s ec, Spring lo aded m ineral insulat ed thermocouple ass embly with 316 SS t hermowell hous ed in al uminium casin g (epoxy coated) having a process connection of M33 x 2 thread or 150 RF flanged. Material of accessories will be SS. IP 65 or equivalent degree of p rotection for enclosure. Thermowell with hex head of fabricated assembly for air and flue gas system, for rest of the services bar stock assembly ungrounded.</p> <p>Thermowell material shall be solid tungsten carbide for mill out let temperature measurement. For Air &amp; Flue Gas measurements, thermowells shall be made of Inconel. For metal tem perature m easurement, ther mocouple pads weldable to M.S pipes shall be provided with 15 m thermocouple extension wires. Element size shall be 18 AWG. Insulation resistance at 540°C shall not be less than 5 M ohms. F or Turbine applications process connection shall be welded as per DIN 43763.</p> <p>Temperature devices p rovided wi th t hermowell sh all be ca librated w ith the associated thermowell as an assembly. The thermowell construction shall meet the ANSI 19.3-1994 (latest) requirements. Thermocouple termination head shall be 300 mm above the pipe insulation to avoid cable damage in hot zones.</p> <p><b><u>Thermo wells</u></b> shall be provided along with Temperature elements of RTD &amp; Thermocouples except for metal/bearing/winding temperature measurements.</p> <ol style="list-style-type: none"><li>1. For measurement of flue ga s temperat ure, Incona l c oated with tung sten carbide or suitable abrasion resistant thermo wells shall be provided.</li><li>2. For m easurement of p ulveriser out let temperature tungsten c arbide bl ock thermo wells abrasion resistant not tungsten carbide coated thermowell shall be used. Also the terminals of Thermocouple shall not be at the top of Mills itself. The thermocouple wires are to be laid up to JB through SS tubing of required diameter and th e head s hall be placed n earer to th e JB. Compensating ca ble ex posed to at mosphere i n th e conv entional m ethod melts away due to high temperature at the top of Mill.</li><li>3. For measurement of water &amp; steam temperature SS thermo wells or better, shall be used</li></ol>	





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meet the ANSI 19.3-1994 (latest) requirements.

**13.00.00      Level gauges:**

Tubular type level gauges for low pressure upto 7 kg/cm<sup>2</sup> & reflex type for high pressure water & steam services & vacuum services with automatic ball check valves, illuminator (240 A.C), pyrex / borosilicate glass, mica shield, brass guard rods & brass holders. Material of accessories (name plate, etc.) will be SS. Tubular glass OD will be 5/8". Vent & drain valves shall be provided. Connection shall be screwed or flanged (ANSI class 150 RF). Enclosure shall be IP 65.

**14.00.00      Level Switches:**

External float operated level switches for tanks and vessels and top mounted level switches and underground tanks. The top mounted level switches shall be supplied with steel tubes to suit Purchaser's requirement. Micro switch with 2 SPDT contacts rated for 0.2 A, 220 V DC. Material of float & float chord will be 316 SS & cage material shall be fabricated steel and the material of accessories will be SS. IP 65 or equivalent degree of protection for enclosure.


Accessories like name plate, drain valve for external case type level switches, mating flange, gaskets (asbestos), fasteners, bolts & nuts, etc. shall be supplied.


**15.00.00      Flow Glasses:**


Online flow glasses for pipe size up to 4" with a rotary wheel (not a flapper type) suitable for installation on vertical or horizontal pipe lines, material pyrex tempered glass. Body material will be carbon steel, rotor & wetted parts will be bronze. The material of accessories will be SS. IP 65 or equivalent degree of protection for enclosure. Upto 50 NB size, connection shall be screwed above 50 mm NB size it shall be flanged - ANSI, 150 RF. Accessories like name plate, mating flanges with gaskets (neoprene), bolts & nuts, etc. shall be supplied. Enclosure shall be IP65.

**16.00.00      Flow Elements:**

SS 316 flow nozzles for all steam and feed water services with D and D/2 pressure tapplings; 316SS flow orifice plate assembly for all water services with flange tap connections; B ratio of 0.5 & 0.7. Element material of SS 316. The material of accessories will be SS. All the flow elements shall have 3 pairs of differential pressure tapplings complete with root valves. Orifice plate shall not be less than 3 mm thick for nominal pipe diameter upto


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	<p>300 mm &amp; not less than 6 mm thick for pipe diameter &gt; 300 mm. The flow elements shall be supplied as assemblies with High/low pressure tappings, root valves as required. Performance Guarantee flow elements shall be provided separately. Butt welded edges shall be prepared as per ANSI 16.25 &amp; flanged connections shall be as per ANSI 16.5 standards. Orifice assembly complete with nipples &amp; valves to be supplied by Bidder shall be one metre long with ANSI class 150 RF SS flanges at the ends including gaskets, bolts &amp; nuts. Isolating valves shall have SW end connection. Accessories like name plate, gaskets, bolts &amp; nuts, reservoirs (condensing chambers), 6 nos. shut off valves per assembly, nipple, welding adapters, etc. shall supplied.</p> <p>Bidder shall submitted certified flow calculation and differential pressure V s. flow curves for each element for OWNER's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for OWNER's approval. Bidder shall provide three Tappings per flow elements.</p> <p><b>17.00.00      <u>Flow Switches:</u></b></p> <p>Indicating, Differential pressure, flapper type on line flow switches for line sizes up to 80 mm with an accuracy of +/-2% of span and dial size of min. 50 mm having 316 SS flapper housed in die cast aluminium. Micro switch with adjustable range with 2 SPDT contacts rated for 0.2 A, 220 V DC. IP 65 or equivalent degree of protection for enclosure. The material of accessories will be SS.</p> <p><b>18.00.00      <u>Solenoid Valves:</u></b></p> <p>Direct operated single/dual coil solenoid valves with shut off class (leakage) IV or better, body material of bronze, plunger material of 316 SS rated for continuous duty. IP 65 or equivalent protection class for enclosure. Insulation class of 'F' for the solenoid. Body ratings shall suit the pressure and temperature conditions.</p> <p>The operating voltage shall be for 24VDC/ 220 VDC/230VAC/110VAC depending on the service.</p> <p><b>19.00.00      <u>Local Instrument Enclosure &amp; Racks/CJCB,s:</u></b></p> <p>Transmitters mounted in the field shall be suitably grouped together and mounted in Local Instrument Racks (LIR). These local instrument racks shall be furnished as per the actual requirements finalised during detailed engineering stage. The exact grouping of instruments in a particular instrument rack shall be as finalised during detailed engineering stage subject to Employer's approval.</p> <p>The internal layout shall be such that the impulse piping/ blowdown lines are accessible from backside of the rack and the transmitters etc. are accessible from front side for easy maintenance. Bulkheads especially</p>	

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<p>designed to provide isolation from process line vibration shall be installed on instrument racks to meet the process sensing line connection requirement. Vibration dampeners shall be installed for each rack.</p> <p>The instrument racks shall be free standing type constructed of suitable 5 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack. Bulk heads, especially designed to provide isolation from process line vibration shall be provided. Exact fabrication details shall be as finalised during detailed engineering stage. The junction box for racks also shall conform to IP 65 protection class.</p> <p>Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided.</p> <p>Each transmitter rack housing instruments requiring purge air for continuous air purging, shall be provided with common purge air header, redundant air filter regulators of sufficient capacity, required pressure gauges, valves, fittings, SS tubings and individual purge meters for each purge line etc. as required.</p> <p>A 15 mm NB service air header shall be furnished in each rack housing air &amp; flue gases and coal mill instruments. The header shall be furnished complete with a pressure regulating valve, pressure gauge, and valve quick disconnect connections. A hose for connecting each header to the draft instrument line four-way valves shall be furnished. The hose shall be self-storing nylon tubing having a burst pressure of 15 kg/sq.cm. The size of the hose shall be 1/2" minimum. The service air header shall originate at a bulkhead penetration or fitting located on one of the bulkhead plates.</p> <p>The contractor shall prepare the piping drawings and the general arrangement layout drawings for each of the racks. Special attention shall be given in the piping layout to avoid air traps in liquid filled piping or water pockets in piping intended to be dry. Drawings shall indicate the arrangement of all equipment, piping, valves and fittings within, the racks and shall be subject to Employer's approval.</p> <p>All liquid filled blow down lines, except those measuring vacuum shall be connected to a two inch header which is extended through one end of the enclosure and turned downward for directing the blowdown into a drain. The material of the blow down header shall be carbon steel as per ASTM A 106 Gr C.</p>		

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<p><b>20.00.00</b></p>	<p><b><u>Junction Boxes:</u></b></p> <p>Wall/column mounted junction boxes having 12/24/36/48 terminals and cable entry only at the bottom and sealed with fire proof compound; Cage clamp terminals suitable for cable terminations up to 2.5 sq mm.; IP 65 or equivalent degree of protection for enclosure. Separate terminal blocks shall be used for analog and digital signal signals. Separate JB's for different voltage levels shall be supplied. Removable gland plate shall be supplied. JB shall have single lockable door with gasket, able to open sideways, with common keys. Painting inside will be glossy white &amp; outside - IS-5 shade 631. Shield bus for screw connection shall be provided. Terminal size shall be suitable for 0.5 mm<sup>2</sup> to 2.5 mm<sup>2</sup> wire. Terminal blocks shall be vertical. JB shall have provision to add 20% additional terminals. Accessories like metal tag (SS), clamps, fixtures, bolts (SS), nuts (SS), gaskets (neoprene), lock &amp; key, fire proof compound for sealing, etc. shall be supplied. The grouping of instruments in JB's is subject to Purchaser's approval. All the field Junction boxes shall have double doors. All JB's shall be provided with individual canopies to avoid ingress of water. The case, cover/door constructed from cold rolled sheet steel of 3 mm thick and shall have gland plate of 3 mm CRCA at the bottom.</p> <p><b>21.00.00</b></p> <p><b><u>Inter Posing Relays (IPR):</u></b></p> <p>Electromagnetic type IPRs with plug-in type connections, suitable for channel/rail mounting in cabinets; coil rating 24V D.C; 2 set of silver plated change over contacts rated for 0.2A 220 V DC. Free wheeling diode across relay coil(copper) and self reset type status indicator flag (electronic) shall be provided. Neon/LED indicating lamps shall be provided to indicate energise condition of relay.</p> <p>All commands to the Drives viz., Unidirectional drives, Bi-Directional drives, Solenoids and critical output contacts between systems for interlock and protection shall be through IPR. All relays shall be mounted on relay base (silver plated) internally wired to the external cabling termination block in cabinet. Wiring connection shall be screwed &amp; termination shall be suitable for 0.5 mm<sup>2</sup> to 2.5 mm<sup>2</sup> size wiring. Facility to simulate relay operation manually shall be provided. Relays of different contact interrogation voltages shall be separated by a barrier in IPR cabinet. Accessories like name plate (SS) with tag &amp; service inscription, relay base mounting rail/channel, nuts &amp; bolts, etc. shall be supplied. Three nos. change over contacts shall be wired to external TB with screwed terminations only. Status lamps shall be provided.</p>	

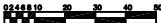





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<p>Input/Output Modules as required in the control system for all type of field input (4-20 mA, RTD, T/C, Digital contacts etc.) and output from the control system are to be provided as per requirement. Electrical isolation for 1.5 KV with optical coupler between the plant put/output and surge protection as per IEEE 472. The hardware design shall be such that it is able to withstand power line disturbance. The system shall conform to ANSI/IEEE C 62.4 (Immunity to power supply line disturbance).</p> <p>Contractor shall provide at least 20% wired spare capacity of input/output modules over and above the system requirement. Contractor shall provide built in diagnostic for easy fault detection.</p> <p>System shall be able to operate in non air conditioned area. However where PLC panels/ I-O racks are located at local areas in dusty and hot zone, PLC panels/I-O racks shall be provided with air condition with suitable protection class. Contractor may provide Annunciation System as integral part of PLC. Field contacts shall be acquired through PLC only. The Annunciation sequence logic shall be implemented as a part of PLC controllers. The No. of Annunciation facia windows and provision of original input will be on as required basis.</p> <p>Contractor shall provide electronic grounding for PLC which shall be separate from Electrical grounding as per IS or IEEE Standard.</p> <p>The Factory Acceptance Test for PLC system shall consist of a) Hardware &amp; Software as per BOM b) Spare capacity in cabinet for new module c) Current &amp; Power Consumption d) Power Failure Test e) Healthiness of Hardware/all module f) On line removal of I/O card g) Accuracy Test h) Diagnostic Test i) Functional Test j) Verification of Software k) Redundancy Test of Controller l) Redundancy Test of power supply m) CPU loading duty cycle n) Power failure auto restart. Any other Test as per QAP. The Type test reports also shall be submitted for review.</p>		

Approval Category:.  
'A' APPROVED AS SUBMITTED  
Release distribution prints.  
Transmittal No: E072-BHEL\_PEM-0-I-12-1088  
Date: 06-07-2012

# DRIVE CONTROL & MEASUREMENT PHILOSOPHY

REV. 04	DATED. 12.06.12	ALTD GA	CHKD RKR	APPD MAM
1.	REVISED IN LINE WITH MOM DTD 06 JUN 12 WITH CUSTOMER/CONSULTANT AT KPCL, BANGALORE.			
REV. 03	DATED. 30.04.12	ALTD GA _sd_	CHKD RKR _sd_	APPD MAM _sd_
1.	REVISED IN LINE WITH CUSTOMER COMMENTS RECD. VIDE TRANS. NO. E072-BHEL-0-I-12-808 DTD 11.04.2012			
REV. 02	DATED. 15.03.12	ALTD GA _sd_	CHKD RKR _sd_	APPD MAM _sd_
1.	REVISED IN LINE WITH MOM DTD 01/02 MARCH 2012 WITH CUSTOMER/CONSULTANT AT BHEL-PEM, NOIDA.			
JOB NO.		362		
STATUS		CONTRACT		
PRINT SCALE				
				
REV. 01	DATED. 16.12.11	ALTD GA _sd_	CHKD RKR _sd_	APPD MAM _sd_
1.	REVISED IN LINE WITH CUSTOMER COMMENTS RECD. VIDE TRN NO. E072-BHEL-0-I-11-58 DTD 14.01.11 AND FINAL RESOLUTION HELD AT STEAG, NOIDA ON 08.12.11			

OWNER:  RAICHUR POWER CORPORATION LTD.

CONSULTANT:  STEAG Energy Services (India) Pvt. Ltd  
NOIDA


PROJECT: 2X800 MW YERAMARUS STPS




BHARAT HEAVY ELECTRICALS LTD  
POWER SECTOR  
PROJECT ENGINEERING MANAGEMENT  
NOIDA

DEPT CODE	DRN	NAME GA	SIGN	DATE
I	DSGN	RKR	-sd-	14.12.2010
	CHD	MAM	-sd-	14.12.2010
	APPD	MAM	-sd-	14.12.2010

TITLE: DRIVE CONTROL & MEASUREMENT PHILOSOPHY

						SCALE 	DRAWING NO. PE-DM-362-145-I002
						SHEET 1 OF 13	REV 04

	DOCUMENT TITLE DRIVE CONTROL & MEASUREMENT PHILOSOPHY	DOCUMENT NUMBER	PE-DM-362-145-I002		
		REVISION NUMBER	03	DATE	27-04-2012
	PROJECT: 2X800 MW YERMARUS STPS	SHEET	2	OF	13

## A. DRIVE CONTROL PHILOSOPHY

The control philosophies for different type of Drives are detailed below:


### 1 Bi-directional drives with Integral Starter (Open/Close duty and inching/regulating duty)

- a) All bi-directional drives have been envisaged with integral starter. These drives shall be operable from Remote i.e. from Central Control Room (CCR) as well as from local push buttons (LPB) mounted on the integral starters (IS).
- b) Remote manual operation of all drives shall be done from Operator Works Station (OWS). Local operation shall be provided from Local for initial testing /commissioning.
- c) For operation of all drives there will be a local/remote selector switch mounted on the integral starter. The LPB will have open/close/stop facility.
- d) Remote control commands i.e. open/close generated from DCS shall be issued to Integral Starter through interposing relays, mounted in Integral Starters. Latching of open/close commands shall be provided at integral starter.
- e) Necessary electrical protections shall be realized at Integral Starter, whereas process interlocks and protection shall be realized in DCS.
- f) Following signal exchange shall take place between Integral Starter & DCS.
  - open & close command
  - Integral Starter Disturbed (Loss of power/control supply fail, Motor thermostat trip, Thermal O/L, Torque open/close cut off, Local/off/Remote S/S in Local or Off mode etc.).
  - Valve status feedback by means of limit switches (open/close).
  - Valve status feedback by means of Torque switches (open/close).
  - Valve position feedback (4-20mA) for inching duty drives.

*The above drive controls are diagrammatically represented in sheet no. 8.*

### 2 Unidirectional LT Drives (Contactor Operated)

- a. Unidirectional LT drives shall be operable from Remote i.e. from Central Control Room (CCR). Drives shall be provided with Local Emergency Stop Push Button (EPB).
- b. Remote manual operation of all drives shall be done from OWS.
- c. Remote control commands i.e. start/stop shall be generated from DCS and shall be issued to MCC through interposing relays located in respective MCC. EPB (stay put type) shall be wired directly to MCC.

	DOCUMENT TITLE DRIVE CONTROL & MEASUREMENT PHILOSOPHY	DOCUMENT NUMBER PE-DM-362-145-I002	
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	PROJECT: 2X800 MW YERMARUS STPS	SHEET 3	OF 13


- d. The EPB shall be provided with press to lock and turn to release type, keyless mechanism.
- e. Necessary electrical protections for the drives shall be realised at MCC, whereas process interlocks and protections shall be realised in DCS.
- f. Following signal exchange shall take place between MCC & DCS
  - i. Drive Start & Stop commands.
  - ii. Drive ON & OFF feedback.
  - iii. MCC disturbed (Thermal O/L, Control supply fail, EPB operated, MCC isolated).
- g. Current measurement shall be provided in DCS for monitoring on OWS for all drives  $\geq 30$  KW and for important drives  $<30$  KW also. Current transducers shall be provided in MCC.

*The above signal exchanges are diagrammatically represented in sheet no. 9.*

### **3 Sol solenoid Operated Drives**

- a. Solenoid operated drives shall be operable from remote i.e. CCR only.
- b. Remote manual operation of all drives shall be done from OWS.
- c. Remote control commands i.e. open/close shall be generated from DCS and shall be issued to the respective solenoid through interposing relays located in Interposing Relay panels.
- d. Necessary process interlocks shall be realized in DCS.
- e. Following signal exchange shall take place between solenoid operated drive & DCS
  - i. Valve open & close command (for dual coil solenoids two commands and for single coil solenoid one command).
  - ii. Valve status feedback by means of limit switches (open/close), wherever available or from relay contact of interposing relays if Limit Switches are not provided.
  - iii. Power Supply Fail Alarm

*The above signal exchanges are diagrammatically represented in sh. no. 10.*

	DOCUMENT TITLE DRIVE CONTROL & MEASUREMENT PHILOSOPHY	DOCUMENT NUMBER PE-DM-362-145-I002	
		REVISION NUMBER 03	DATE 27-04-2012
	PROJECT: 2X800 MW YERMARUS STPS	SHEET 4	OF 13

#### 4 **HT/LT Unidirectional Drives (Breaker operated).**

- a. Remote manual operation of Breaker operated drives shall be normally from remote i.e. Station DCS in main Control Room through OWS.
- b. Remote/Switchgear selection shall be realized from SWGR mounted R/S selector switch.


- c. Following are the operational combinations for breaker operated drives:

TEST POSITION – Switchgear Testing (Start/Stop) from SWGR/CCR under racked-out condition.

SERVICE POSITION – Drive Operation (Start/Stop) shall be from CCR under racked-in condition.

SWGR mounted 'Trip/Neutral/Close' switch shall be provided for testing of switchgear when 'R/S' selector switch is selected as 'SWGR'.

- d. Remote control commands i.e. start/stop shall be generated from DCS and shall be issued to Switchgear through interposing relays located in respective Switchgear. Backup operation (start/stop) from UCP shall be provided for some essential drives
- e. The EPB shall be wired directly to switchgear. The EPB (stay put type) shall be provided with press to lock and turn to release type, keyless mechanism. Under its locked position, the drive operation shall be inhibited.
- f. Necessary electrical protections for the drive shall be realised at Switchgear, whereas process interlocks and protections are realised in DCS.
- g. Following signal exchange shall take place between switchgear and DCS: -
  - i. Drive Start & Stop commands
  - ii. Drive ON & OFF status feedback (in service and test position of SWGR by main contacts)
  - iii. Switchgear Disturbed (Control power supply fail, Trip coil Unhealthy).
  - iv. Switchgear Available (Breaker in Service and Spring Charged, Trip circuit healthy)
  - v. Trip on Over Load.
  - vi. Master Trip Relay (86 Relay) operated.
  - vii. Emergency Stop PB operated.
  - viii. Selector Switch in Remote.

	DOCUMENT TITLE DRIVE CONTROL & MEASUREMENT PHILOSOPHY	DOCUMENT NUMBER PE-DM-362-145-I002	
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- h. Current transformers and transducers with 4-16-20mA output shall be provided in the SWGR for monitoring the current in DCS and UCP for drive rating above 30 KW and for few essential drives below 30 KW. Auxiliary power supply to these transducers shall be provided from the control power supply of the respective switchgear. The range of the compressed band ammeter on the UCP shall be suitable for indicating full load and starting current.

*The above signal exchanges are diagrammatically represented in sh. no. 11.*

## B. SEQUENCE CONTROL PHILOSOPHY

- 1.0** Sequence control is envisaged for startup and shutdown of main drives and their associated drives from OWS. The drives can be operated manually or automatically through group/sub-group control and through process interlocks.

### **1.1 Sequence Mode Operation**

Sequence controls are organized hierarchically in accordance with the operation concept of the plant process. Accordingly following levels of sequence control exists.

- Functional group control
- Sub group control
- Overall monitoring of sub group control.


**Functional Group Control** logic co-ordinates between functionally cascaded lower level sequence control logics. It performs following functions

- Mode of operation
- Sequential start/stop of sub group.

**Sub Group Control** performs sequence control strategies on main drive and related drives as required by the process and taking care of the healthiness of each drive e.g. BFP along with its recirculation valve, discharge valve and AOP in a sequence, will form a sequence control logic for BFP.

### **1.2 Sequence Start Up Mode**

- 1) **Automatic mode:** - In this mode of operation, once the sequence is initiated, it shall progress without involvement of the operator.

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- 2) **Semi-automatic mode:** - In this mode of operation, once the sequence is initialized, the step progressing shall be displayed on the OWS. But the step execution command shall be interlocked and shall be sent by the operator via keyboard. It shall be possible to bypass and/or simulate one or more criteria to enable the program to proceed. This facility shall allow the program to be executed even if some criteria are not fulfilled. It shall be possible to put the system on the auto mode after operating it on semi-auto mode for some steps or vice-versa, without disturbance to the sequence operation.
- 3) **Operator test mode:** It shall be possible to use the sequential control in operator guide mode / test mode i.e. the complete system runs and receives input from the plant OWS but its command output is blocked. The whole program, in this case shall run in manual mode. This mode shall allow to practise manual operation using step and criteria indications. The actual protection shall remain valid during this mode of operation also.

### C. **ANALOG CONTROL & MEASUREMENT PHILOSOPHY**

#### 1) **Analog Drives Control**

- 1.1 A drive control function residing in DPUs is used to position the pneumatically/electrically operated control valves. Interlock and protection Open/Close Commands, originating from field or generated internally in Control Logics (ACS), are interfaced with the drive control function residing in processors.
- 1.2 Control Valve actuator design shall take care of fail safe condition i.e. bringing valve to full open/full close or stay put mode, on signal (pneumatic/electric) failure.
- 1.3 Auto/Manual operator control and display for various control loops shall be provided through OWS, using Analog Displays.
- 1.4 Analog Displays have following functionality:
  - Auto/Manual selection with control device “Raise/Lower Buttons”
  - Set point indication with “Raise/Lower Buttons”
  - Indication for deviation between set point and measured value
  - Measured value indication
  - Final control element position indicators
  - Power supply fail alarm (for SOVs)

*The above signal exchanges with DCS are diagrammatically represented in sh.no. 12.*

	DOCUMENT TITLE DRIVE CONTROL & MEASUREMENT PHILOSOPHY	DOCUMENT NUMBER PE-DM-362-145-I002	
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## 2) Measurement Philosophy

Depending upon the criticality of Control / Monitoring, dual/triple sensor redundancy is provided for Primary sensors.

2.1 Median / Average Value Selection philosophy for transmitters / sensors shall be used for controls. This selection will be possible from OWS, using Analog Displays. Primary sensor redundancy for Control/measurement shall be decided as per following criteria:

- Critical controls, and respective measurements and compensation - Triple redundant.
- Non-critical but important control, & measurements and compensation- Dual redundant.
- Only measurement and compensation- No redundancy.

2.2 In case of dual/triple sensor redundancy, Output Value of signal selector shall be used for:

- Control
- Temp. & Press. Compensation for Level & Flow measurement
- Measurement
- Alarm
- Interlock

*The interface block diagram for measurement of analog and digital signals DCS are diagrammatically represented in sh.no. 13.*

## D) CABLE :

For interconnection of analog signals (4-20mA) to DCS 0.5sq mm, color coded, individually and over all screened, twisted pair cable shall be used (F Type).

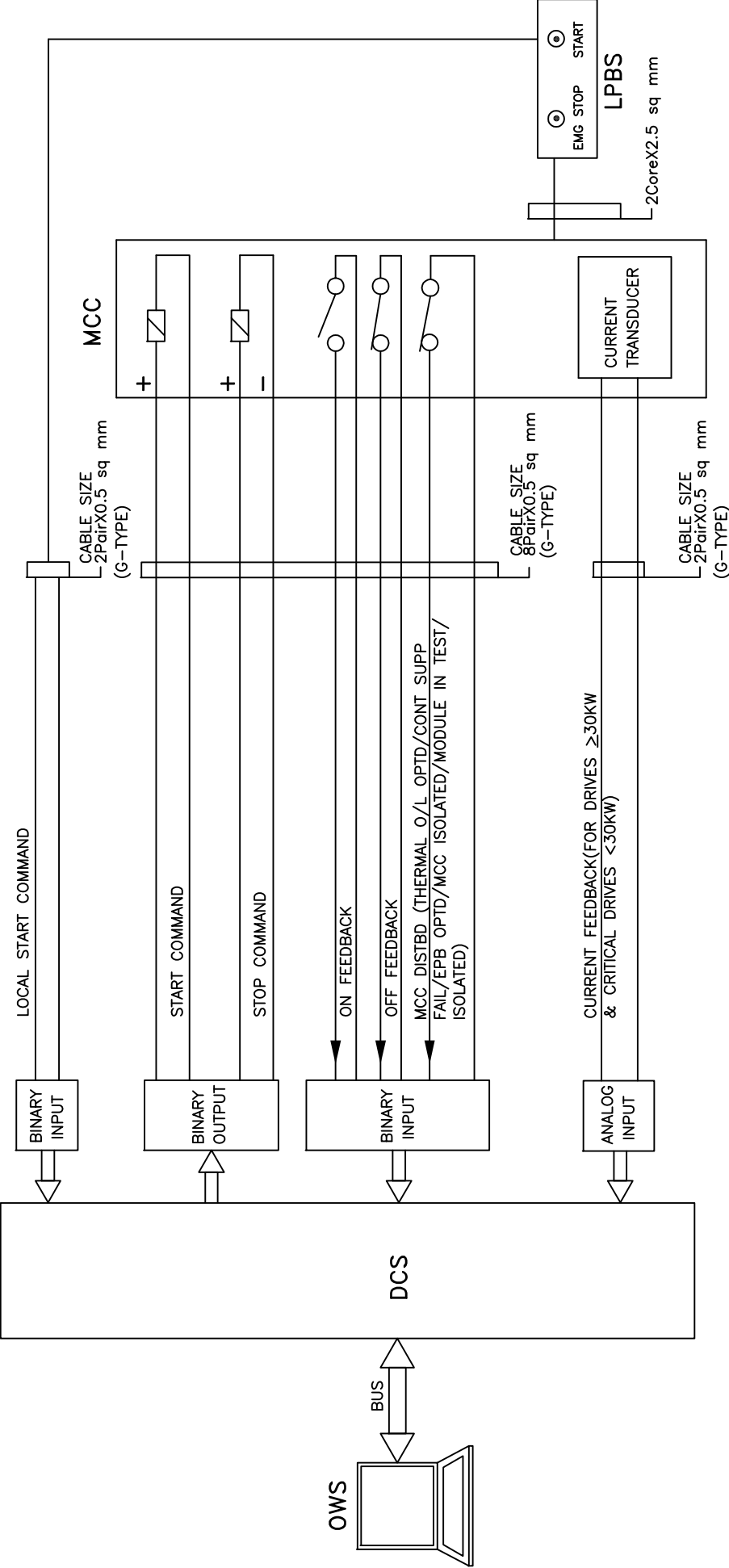
For interconnection of binary signals (24V DC) to DCS, 0.5sq mm, color coded, over all screened twisted pair cable shall be used (G Type).


For interconnection of binary Output from DCS to IPR panel, 1.5sq mm, color coded, over all screened twisted pair cable shall be used (G Type).

Cable scope of supply shall be as per "Cable Block Diagram, document no. PE-DG-362-145-I003".

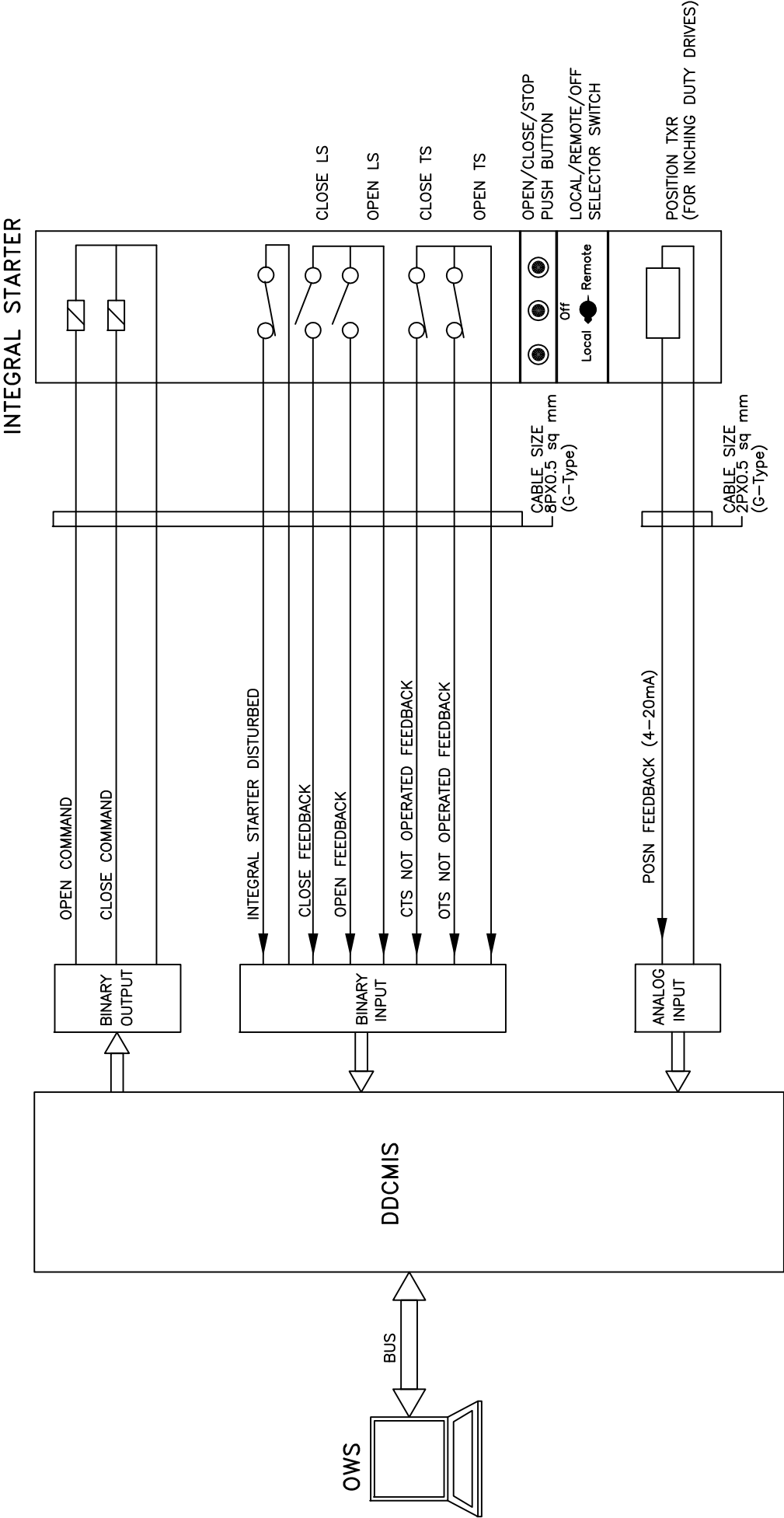


DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE-CONTACTOR OPERATED




	PROJECT:		2X800 MW YERAMARUS STPS		DRG.NO.	PE-DW-362-145-I002	
	TITLE		DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE-CONTACTOR OPERATED		DATE	15.03.2012	
					REV.NO.	02	
			SHT	9	OF	13	

DCS INTERFACE FOR BIDIRECTIONAL DRIVE (WITH INTEGRAL STARTER)

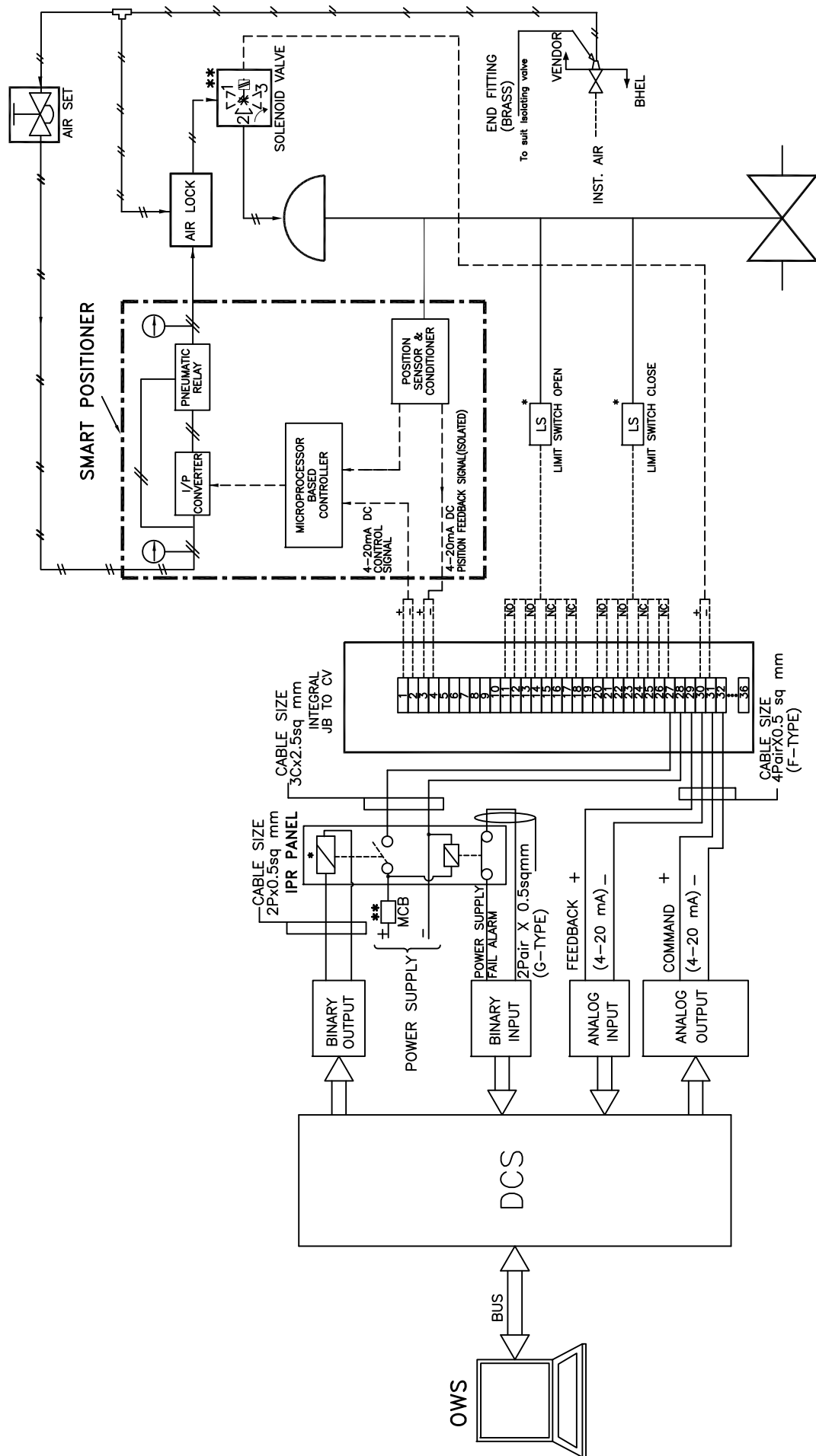


NOTE:

1. DISTURBED= Loss of Power supply (1 Phase/3 Phase),  
Loss of control supply, Motor thermostate trip,  
Thermal over load relay trip etc.

	PROJECT:		2X800 MW YERAMARUS STPS	DRG.NO.	PE-DW-362-145-I002		
	TITLE		DDCMIS INTERFACE FOR BIDIRECTIONAL DRIVE	DATE	14.12.2010		
						REV.NO.	00
						SHT	8 OF 13

# DCS INTERFACE FOR ANALOG DRIVE



## NOTE:-

- \*\* WHEREVER REQUIRED
- \* WHEREVER REQUIRED LIMIT SWITCHES SHALL BE WIRED TO DCS FOR INTERLOCK (RECIRCULATION VALVES, ON/OFF DUTY CONTROL VALVES & WHEREVER REQUIRED FOR INTERLOCK).



PROJECT:

2X800 MW YERAMARUS STPS

DRG.NO. PE-DM-362-145-1002

DATE 11.06.2012

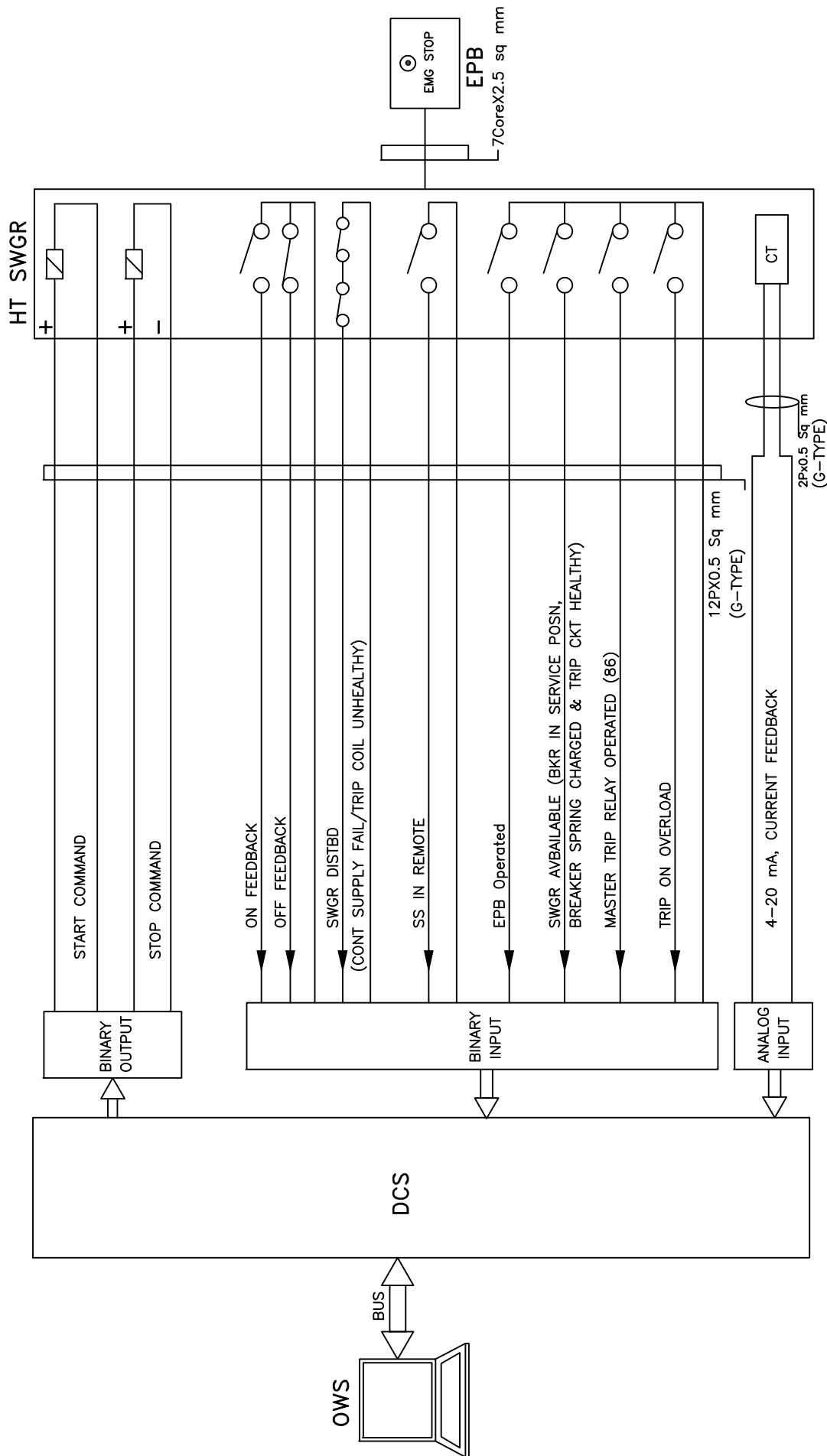
TITLE TYPICAL HOOK-UP DIAGRAM


REV.NO. 03

SHT 12 OF 13

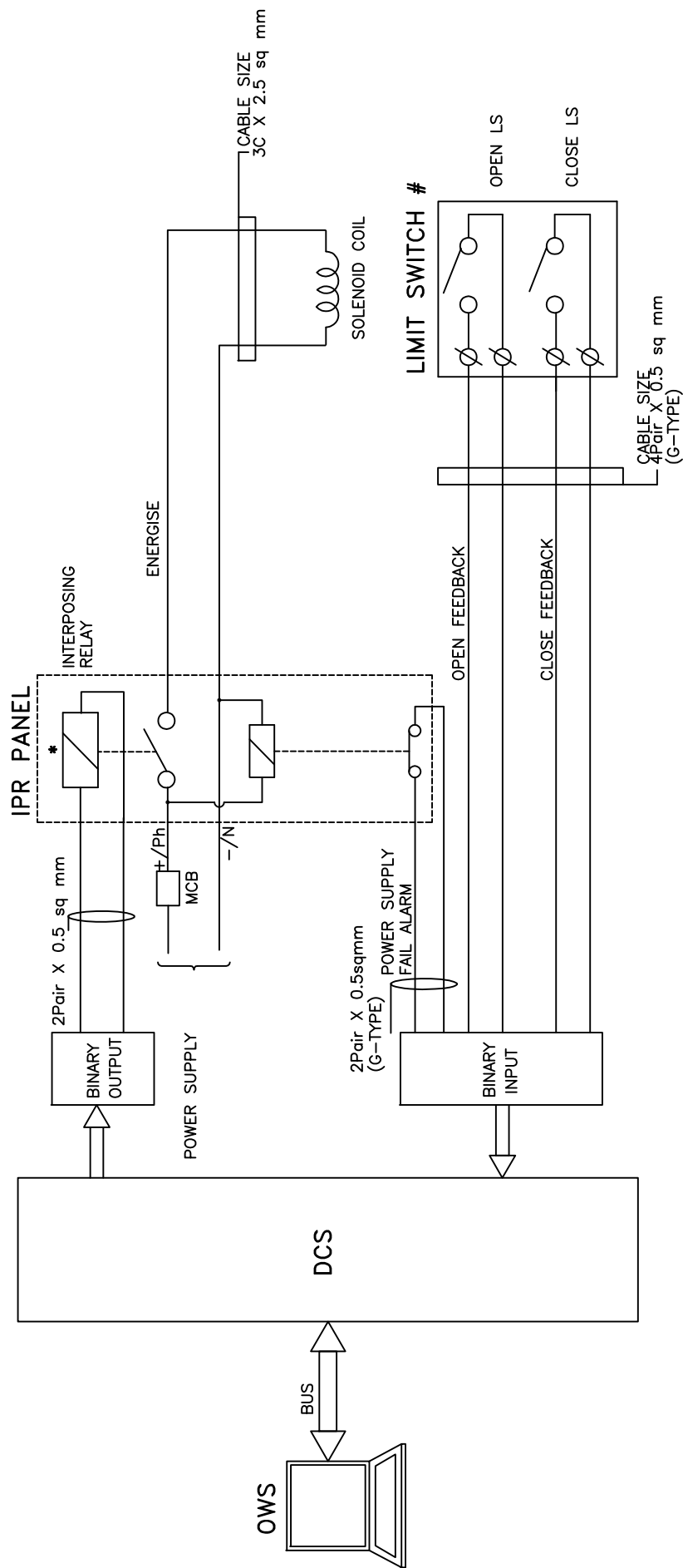
ANALOG DRIVE

# DCS INTERFACE FOR UNIDIRECTIONAL HT/LT DRIVE-BREAKER OPERATED




	PROJECT:	2X800 MW YERAMARUS STPS		DRG.NO.	PE-DM-362-145-I002
	TITLE	UNIDIRECTIONAL HT/LT DRIVE-BREAKER OPERATED		DATE	15.03.2012
				REV.NO.	02
				SHT	11 OF 13

DCS INTERFACE FOR SOLENOID DRIVE  
(24V DC / 240V AC UPS)

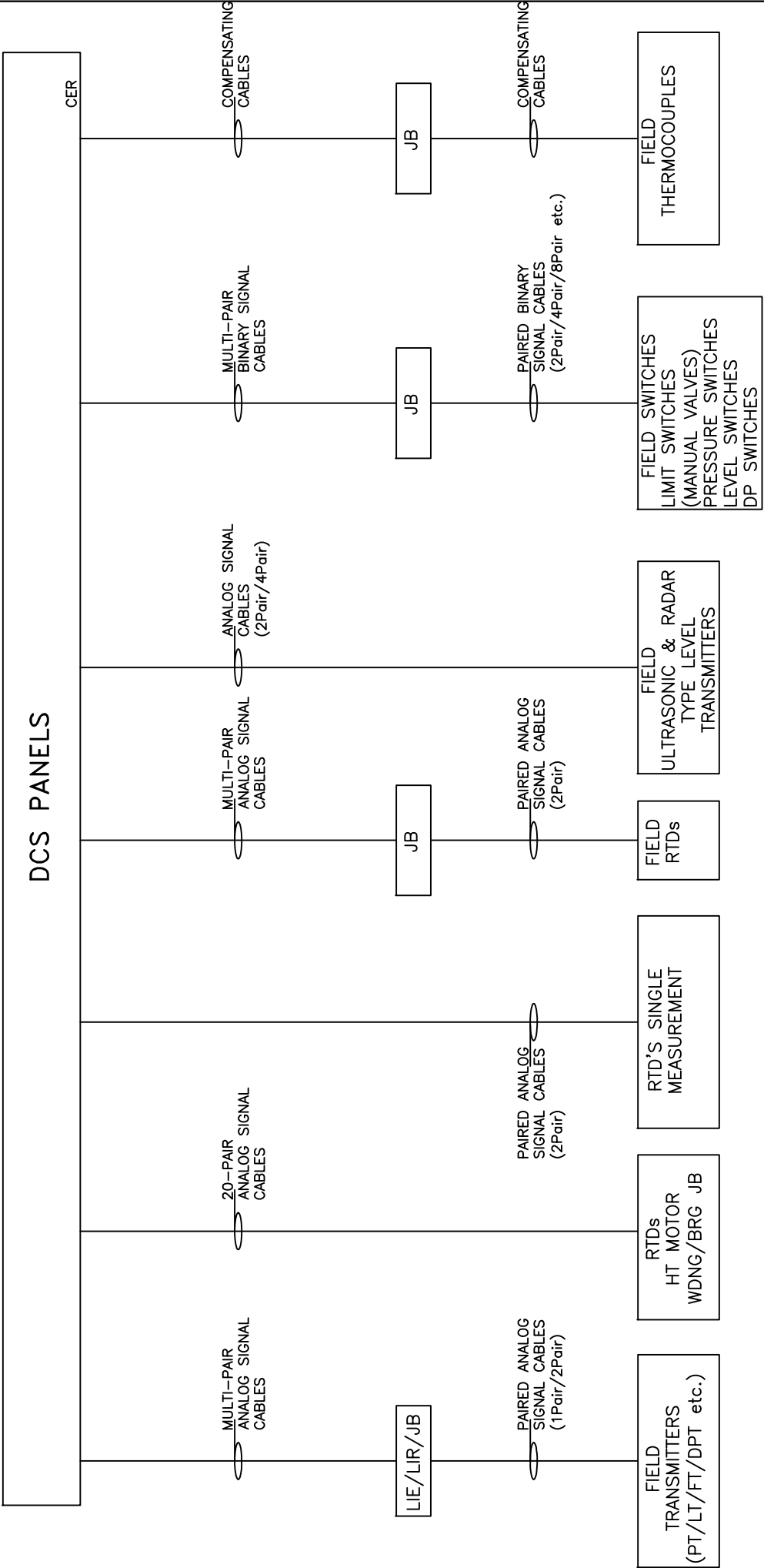


NOTES:  
\* TWO INDEPENDENT OUTPUTS FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH-PULL TYPE VALVES, WITH DUAL COIL SOLENOIDS.


# FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

	PROJECT:		2X800 MW YERAMARUS STPS		DRG.NO.	PE-DM-362-145-1002	
	TITLE		DDCMIS INTERFACE FOR SOLENOID DRIVE		DATE	15.03.2012	
					REV.NO.	02	
			SHT	10 OF 13			

INTERFACE BLOCK DIAGRAM FOR MEASUREMENT OF ANALOG AND DIGITAL SIGNALS



**LEGENDS:**  
LIE-LOCAL INSTRUMENT ENCLOSURE  
LIR-LOCAL INSTRUMENT RACK  
JB-JUNCTION BOX

	PROJECT:	2X800 MW YERAMARUS STPS	
		DRG.NO.	PE-DM-362-145-1002
	TITLE	INTERFACE BLOCK DIAGRAM FOR MEASUREMENT OF ANALOG AND DIGITAL SIGNALS	
		DATE	30.04.2012
	REV.NO.	03	
	SHT	13	OF 13



## SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.: PE-ID-3: 6-145-I902

VOLUME II B

SECTION D

REV. NO. 00

DATE: 07.12.10

SHEET 1

OF 3

### Data Sheet A & B

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

<b>GENERAL*</b>	* PROJECT	2X800 MW YERMARAS STPS		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	<input type="checkbox"/> ON / OFF <input checked="" type="checkbox"/> INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	<input checked="" type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE <input type="checkbox"/> BUTTERFLY		
	* OPENING / CLOSING TIME			
	* WORKING PRESSURE			
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%		
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY		
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
<b>CONSTRUCTION AND SIZING</b>	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:55		
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL		
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.		
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.		
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. <b>FOR INCHING(REGULATING) SERVICE 150 STARTS/HR MINIMUM</b>		
<b>HANDWHEEL</b>	* REQUIRED	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
	* ORIENTATION	<input type="checkbox"/> TOP MOUNTED <input type="checkbox"/> SIDE MOUNTED		
	TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.			
<b>ELECTRIC ACTUATOR</b>	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY		
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY		
	MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT.		
	ACTUATOR APPLICABLE WIRING DIAGRAM	<input checked="" type="checkbox"/> ENCLOSED (BIDDER TO CONFIRM) A: <input checked="" type="checkbox"/> DRG. NO. 3-V-MISC-24227 R00 B: <input type="checkbox"/> DRG. NO. 3-V-MISC-24550 R00 C: <input type="checkbox"/> DRG. NO. 3-V-MISC-24283 R00 D: <input type="checkbox"/> DRG. NO. 4-V-MISC-90271 R11		
	COLOUR SHADE	<input type="checkbox"/> BLUE (RAL 5012) ENAMEL <input type="checkbox"/> .....		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		
	STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY		
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY		
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER <input type="checkbox"/> 230 V <input type="checkbox"/> 110 V		
	@ ENCLOSURE CLASS OF MOTOR	<input type="checkbox"/> IP 65 <input type="checkbox"/> IP 67 <input type="checkbox"/> FLAME PROOF <input type="checkbox"/> IP 55, TOTALLY ENCL, SELF VENTILATED.		
	@ INSULATION CLASS	<input type="checkbox"/> CLASS-B <input type="checkbox"/> CLASS-F		
	@ WINDING TEMP PROTECTION	<input checked="" type="checkbox"/> THERMOSTAT (3 Nos., 1 IN EACH PHASE) <input type="checkbox"/> .....		



# SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.: PE-ID-3: 6-145-I902

VOLUME II B

SECTION D

REV. NO. 00

DATE: 07.12.10

SHEET 2

OF 3

## Data Sheet A & B

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED		
<b>INTEGRAL STARTER</b>	INTEGRAL STARTER	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	TYPE OF SWITCHING DEVICE	<input checked="" type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS		
	TYPE	<input checked="" type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)		
	<b>IF SMART</b>			
	a) SERIAL LINK INTERFACE	<input type="checkbox"/> INTEGRAL <input type="checkbox"/> FIELD MOUNTED		
	b) SERIAL LINK PROTOCOL	<input type="checkbox"/> FOUNDATION FIELD-BUS <input type="checkbox"/> PROFI-BUS <input type="checkbox"/> TCP/IP <input type="checkbox"/> .....		
	c) SERIAL LINK MEDIA	<input type="checkbox"/> TWISTED PAIR Cu-CBL <input type="checkbox"/> CO-AXIAL Cu-CBL <input type="checkbox"/> OFC		
	d) HAND HELD PROGRAMMER	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	e) MASTER STATION	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	f) MASTER STN INTRFACE WITH DCS	<input type="checkbox"/> MODBUS <input type="checkbox"/> TCP/IP		
	g) DETAILS OF SPECIAL CABLE	<input type="checkbox"/> ENCLOSED <input type="checkbox"/> NOT REQUIRED		
	STEP DOWN CONT. TRANSFORMER	<input checked="" type="checkbox"/> REQUIRED		
	OPEN / CLOSE PB	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	STOP PB	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	INDICATING LAMPS	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	LOCAL REMOTE S/S	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	STATUS CONTACTS FOR MONITORING	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)		
<b>INTERPOSING RELAY</b> (Applicable for integral Starter)	INTERPOSING RELAYS	REQUIRED		
	INTERPOSING RELAY (QUANTITY)	<input type="checkbox"/> 2 NOs. <input checked="" type="checkbox"/> 3 NOs.		
	DRIVING VOLTAGE	<input checked="" type="checkbox"/> 20.5 – 24V DC <input type="checkbox"/> _____ V DC		
	DRIVING CURRENT	<input checked="" type="checkbox"/> 125mA MAX <input type="checkbox"/> _____ mA MAX		
	LOAD RESISTANCE	<input checked="" type="checkbox"/> > 192 ohms - <25 k ohms <input type="checkbox"/> > _____ ohms - < _____ ohms		
<b>TORQUE SWITCH</b> (Not Applicable for Smart Actuator)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN / CLOSE	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos. / <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos		
	CONTACT TYPE	2 NO + 2 NC		
	RATING	5A 240V AC AND 0.5A 220V DC		
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE		
	ACCURACY	+3% OF SET VALUE		
<b>LIMIT SWITCH</b> (Not Applicable for Smart Actuator)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2 Nos.	2 Nos. (ADJ.)	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos.
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		





## SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.: PE-ID-3: 6-145-I902

VOLUME II B

SECTION D

REV. NO. 00

DATE: 07.12.10

SHEET 3

OF 3

### Data Sheet A & B

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

<b>POSITION TRANSMITTER</b>	POSITION TRANSMITTER (For inching duty)	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	MFR & MODEL NO.	BIDDER TO SPECIFY		
	TYPE	<input checked="" type="checkbox"/> ELECTRONIC (2 WIRE) R/I CONVERTER <input type="checkbox"/> ELECTRONIC (2 WIRE) CONTACTLESS		
	SUPPLY	<input checked="" type="checkbox"/> 24V DC <input type="checkbox"/> .....		
	OUTPUT	<input checked="" type="checkbox"/> 4-20mA		
	ACCURACY	$\pm 1\%$ FS		
<b>SPACE HEATER</b>	@SPACE HEATER	REQUIRED		
	@ POWER SUPPLY			
	@ RATING			
<b>TERMINAL BOX</b>	MOTOR TERMINAL BOX	REQUIRED		
	ACTUATOR TERMINAL BOX	REQUIRED		
	ENCL CLASS MTR T.B. / ACTUATOR T.B.	@ <input type="checkbox"/> IP 65    @ <input type="checkbox"/> .....	<input type="checkbox"/> IP65 <input type="checkbox"/> .....	
	@ EARTHING TERMINAL	REQUIRED		
	PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	<input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED <input type="checkbox"/> 2 NOS. <input type="checkbox"/> .....		
<b>CABLE GLANDS</b>	@ POWER CABLE GLAND	SIZE:-----		
	@ SPACE HEATER CABLE GLAND	SIZE:-----		
	OTHER CONTROL CABLE GLANDS-1	INSTRUMENT CABLE SIZE FOR ON/OFF DUTY VALVES SHALL BE 8PX0.5 SQMM - ONE CABLE GLAND OF OD SIZE 20 MM. INSTRUMENT CABLE SIZE FOR INCHING DUTY TYPE VALVES SHALL HAVE TWO NO. CABLES (ONE NO. 8PX0.5 SQMM AND 2ND 2PX0.5 SQMM) - TWO NO. GLANDS OF OD SIZES 20 MM & 15 MM.		
	OTHER CONTROL CABLE GLANDS-2			
<b>WEIGHT</b>	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY		_____ Kg.

**NOTES:**

1. **SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. **CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:  
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS INSTRUMENT CABLE SIZE FOR ON/OFF DUTY VALVES SHALL BE 8PX0.5 SQMM - ONE CABLE GLAND OF OD SIZE 20 MM.
6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN INSTRUMENT CABLE SIZE FOR INCHING DUTY TYPE VALVES SHALL HAVE TWO NO. CABLES (ONE NO. 8PX0.5 SQMM AND 2ND 2PX0.5 SQMM) - TWO NO. GLANDS OF OD SIZES 20 MM & 15 MM.
7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

<b>NAME</b>	<b>PREPARED BY</b>	<b>CHECKED BY</b>	<b>APPROVED BY</b>	<b>VENDOR COMPANY SEAL</b>
	VENKAT AGRAWAL	RAVINDER RAINA	M A MANSOORI	NAME
	SIGNATURE			SIGNATURE
DATE				DATE

NOTES\* = TO BE FILLED BY MPL (LEAD AGENCY).

@= TO BE FILLED BY ES



TITLE:

**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**

**2X800 MW YERAMARUS TPS, KARNATAKA**

BHEL DOCUMENTS NO.: PE-TS-3: 6-160-A001

VOLUME **II-B**

SECTION -D

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00

DATE:

Page

**VOLUME – II B**

**SECTION-D**

**STANDARD TECHNICAL REQUIREMENTS**



TITLE:

**TECHNICAL SPECIFICATION FOR  
AIR RECEIVER**

BHEL DOCUMENTS NO.: PE-TS-3: 6-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

**1.0 GENERAL**

This standard specification covers the design, material of construction, features, manufacture, inspection & testing at VENDOR'S and/or his sub-vendors' works, suitable painting and packing requirements of air receiver

**2.0 CODES & STANDARDS**

As far as possible, the design, manufacture and performance of air receivers shall be in accordance with the latest applicable Indian/British/American/DIN standards.

The latest editions of the following shall be followed in particular:

IS: 2825 – Code for unfired pressure vessels

ASME – Section-VIII, Division-1

BS – 487-Fusion welded steel air receivers

IS: 7938 – Air receivers for compressed air installation

The materials of the various components shall conform to applicable IS/BS/ASTM/DIN standards.

**3.0 DESIGN AND CONSTRUCTION**

- 3.1** The air receivers shall be vertical self-supporting cylindrical vessels with supporting stands for resting on the civil foundation.
- 3.2** Other design parameters and design internal pressure of the receiver shall be as per the data specification sheet, if any, enclosed. The receiver shall be designed as per IS:7938.
- 3.3** Receivers shall be of welded construction with a minimum number of joints. Longitudinal seams in adjacent section of shell shall not be in the same line.
- 3.4** Receivers shall be provided with gasket inspection openings. Receivers below 500 mm diameter shall have at least two inspection holes. For receivers of larger diameter, manhole of minimum 450 mm diameter shall be provided. These openings shall be placed as far as possible from any welded seam and in no instance shall pierce any seam.
- 3.5** All welding shall be performed in accordance with relevant codes. Filler material that will deposit weld metal with a composition and structure as near as that of the material being welded shall be used. All welding electrodes shall be got approved by the Owner. The electrodes shall be



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dried in ovens immediately before use to ensure freedom from porosity. All the circumferential and longitudinal butt welds of the air receiver shall be subjected to spot radiography. Tee joints and dished welding shall be subjected to 100% radiography.

- 3.6** All other welding on the air receiver, including fillet weld and nozzle connection shall be DP tested as per IS: 2825 (Para 8.7.11).
- 3.7** Each finished receiver complete with all welded attachments shall be hydraulically tested at 150% of the design pressure. The test pressure shall be maintained for at least 30 minutes. All joints shall be gentle hammered during the test.
- 3.8** Receivers shall be provided with relief valve of the capacity and set pressure of the same at least 10% above working pressure. The spring in the relief valve in service for pressure up to and including 250 psi shall not be reset for any pressure more than 10% above or below the design set pressure. For higher pressures, the spring shall not be reset for any pressure more or below 5% design set pressure.
- 3.9** Each air receiver shall be complete with drain connection of 25 mm NB with a trap station consisting of a trap, strainer, isolation and bypass valves.
- 3.10** The receiver shall be provided with necessary number of nozzles. The orientation of the nozzles shall be subjected to the approval of the Owner.
- 3.11** Local instruments like pressure gauge, switch and temp. gauge of suitable range shall be supplied. Please refer specification for conveying air compressor for other instrumentation required.
- 3.12** The vendor will have all welding procedures & welders qualified in accordance with the relevant codes prior to commencing any welding at the works. These tests shall be witnessed by customer/client representative.



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**1.0.0 GENERAL**

This specification covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-constructor's works of hand operated chain pulley block.

**2.0.0 CODES AND STANDARDS**

The design, manufacture, inspection and testing and performance of hand operated chain pulley blocks shall confirm to latest editions of the following standards: -

- a) IS: 3832                      Specification for hand operated chain pulley block
- b) IS 807: 1976              Codes of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of cranes and hoists
- c) IS: 3109(Part II)        Calibrated load chain for pulley blocks and other lifting appliances
- d) IS: 2429(Part II)        Calibrated hand chain for pulley blocks and other lifting appliances
- e) IS: 4460                      Method for rating of machine cut spur and helical gears
- f) Material Specification IS or approved

**3.0.0 EQUIPMENT****3.1.0 CHAIN PULLEY BLOCK**

The block shall be so designed that all components shall withstand without failure, an application to the block of a load equal to at least four times the working load limit.

**3.1.1 Frame**

Frame shall be robust in design and of welded construction. The frame shall be selected in such a way that head room requirement is minimum. Frame shall maintain alignment under all expected conditions of services.



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**3.1.2 Chain**

The load chain shall be electrically welded, accurately calibrated, and pitched and polished conforming to IS: 6216 Grade 80 as specified in data sheet 'A'.

The hand chain shall also be electrically welded, calibrated, pitched and polished and shall conform to IS: 2429 (Part II) grade 30. The length of chain and link dimension shall be as per IS: 3832.

**3.1.3 Hook**

The forged hook shall be properly heat-treated and so designed that in loaded condition, it is free to swivel without twisting the load chain. The hook shall conform to IS: 3815.

**3.1.4 Reduction Gear**

The reduction gear shall be spur or worm/worm wheel type. The spur gear and worm shall be of high-grade carbon steel and heat treated. The worm wheel shall be of bronze. A detachable steel cover shall be provided for total enclosure of the gear train and ample lubrication to be provided.

**3.1.5 Brakes**

Brakes shall be of screw friction disc type self-actuating or any other approved type as per manufacturer's standard practice. Brake capacity shall be ample and humid atmosphere shall not affect materials used. The brake shall prevent self lowering of load and arrest and sustain load in all working positions. The load brake shall also allow smooth lowering of the load without serious overheating which may impair sufficient working of block

**3.1.6 Bearing**

Bearing used shall be as per guidelines laid down in IS: 3832.

**3.1.7 Wheel**

The load chain wheel shall be made of heavy duty malleable casting and shall be designed to ensure, effective operation of the chain. Load chain, wheel shall be mounted on two ball bearings. Hand chain wheel shall be made from malleable casting/pressed sheet steel. The idler wheel shall be so shaped as to avoid the twisting of the chain during operation. The P.C.D of idler wheels shall be such that the bending action of the link is avoided. The hand chain wheel shall be provided with flanges and designed to ensure effective



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operation with hand chain.

### **3.1.8 Other components**

All other components of chain pulley block such as anchorage, guide, pawl, stripper etc. shall be designed and provided as per IS: 3832.

### **3.2.0 MONORAIL TROLLEY**

Monorail trolley shall be provided if called for in the enclosed Data Sheet—A. Monorail trolley frame shall be of heavy section rolled steel, held together by bolts. Wheels shall be of high grade cast iron mounted on ball bearings. Axles and shafts shall be of carbon steel, accurately machined and suitably supported. The trolley shall be suitable for variations in I section beams. The trolley shall be geared travel type.

The hand chain required for trolley travel shall be as per clause 3.1.2 of this specification.

Hand chain wheel shall be as per clause 3.1.7 of this specification.

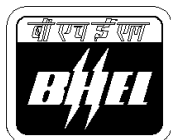
### **4.0.0 INSPECTION AND TESTING**

The scope of inspection shall include but not limited to the following:

- a) Material identification/co-relation for important items like hook, load chain, hand chain, wheels, nut and pawl etc.
- b) Hardness for pawl and ratchet
- c) Dye penetration test for hooks
- d) Operational test including operational effort, velocity ratio etc,
- e) Proof load test up to 1.5 times of working load limit.
- f) Dimensional check of hook
- g) Marking

### **DATASHEET**

<b>S. No.</b>	<b>Parameter Description</b>	
1	Capacity (In Kg)	Suitable for lifting the heaviest load but not less than One (1) ton
2	Service condition	Class II outdoor
3	No. of CPB	1
4	Lift (m)	To suit bunker height and equipment on bunker roof top to be handled.



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5	Type of suspension	Travelling Trolley
6	Head Room	Minimum permissible
7	Type of gear in CPB	Spur Gear
8	Type of bearing	Ball/Roller
9	Grade of Load Chain	Alloy Steel /Gr 80
10	Grade of Hand Chain	Steel / Gr. 30
11	Factor of Safety	As per Relevant IS





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**1.0 GENERAL**

This standard specification covers the design, material construction features, manufacture, inspection & testing at manufacturer's works, painting and packing requirements of air compressor with drive.

**2.0 CODES & STANDARDS:**

2.1 The design, manufacture, inspection & testing of air compressor as specified hereinafter shall comply with the requirements of the latest applicable Indian / British American Standards. The following standards/codes shall be following in particular.

- i) IS:5456 - Code of practice for testing of positive displacement type air compressors and exhauster.
- ii) IS:5727 - Glossary of terms relating to compressors and exhauster.
- iii) IS:6206 - Guide for selection, installation and maintenance of air compressors.

2.2 In case of any conflict between the above mentioned standards / codes and specification, the stipulations in the technical specification shall prevail. In case of any further conflict the same shall be referred to purchaser's engineer for clarification whose decision shall be final & binding.

**3.0 DESIGN AND CONSTRUCTION**

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

The continuous motor rating (at 50<sup>0</sup> C ambient) will be at least ten percent (10%) above the maximum load demand of the driven equipment under the entire operating range. 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.

Noise level of compressors not to exceed 85 dBA to a reference of 0.0002 microbar when measured at a distance of 1.0 m above the floor in elevation and at a distance of 1 m horizontally from the nearest surface of compressor.

Compressors to be designed for Continuous, Load-Unload and On-Off mode operation.

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

**Design / Construction**

- i) Compression chamber Wall thickness to withstand maximum design pressure.
- ii) Casing with a large inlet port for fast filling and low air velocity.



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- iii) To provide suitable arrangement for cleaning of the cooling water jackets during maintenance of compressor.
- iv) Dynamically balanced, one piece Rotors with asymmetric profile, to keep leakage losses to a minimum and ensure high efficiency.
- v) Rotor shaft mounted, oil lubricated, highly precise timing gear shall be designed to counter act the axial forces incurred in compression.
- vi) Life of Oil lubricated anti-friction type bearing be at least 8000 running hours.
- vii) Shaft Seals of floating restrictive ring type design.
- viii) The shaft seal rings and retainers shall be free for radial self-adjustment on the rotor shafts.
- ix) Minimum design service factor for the integral, oil lubricated type, step-up Gear Box shall be of 1.5.
- x) To provide safety valves on low pressure and high pressure stages.
- xi) A direct driven positive displacement type oil pump connection to the main drive shaft is preferred. Alternatively a separate motor driven oil pump be provided.
- xii) The lubrication system to include oil pump, oil filter, oil cooler and oil tank / sump.
- xiii) Cooling shall be by closed circuit Demineralised water.
- xiv) Compressor shall be directly coupled with constant speed squirrel cage induction motor conforming to the technical specification attached elsewhere.

**Material of construction**

The materials of various components shall conform to the applicable BIS / BS / ASTM / DIN standard or any other reputed standards.

- i) Compressor chamber: Cast iron coated with corrosion resistant material.
- ii) Rotors: Forged carbon steel coated with corrosion resistant material
- iii) Timing Gear: Low, Alloy Steel.
- iv) Inlet throttle valve & Housing: Aluminium
- v) Shaft Seals: High, Alloy Steel.
- vi) Safety valves: Brass
- vii) Water separator: Cast Iron



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- |       |                                       |                                     |
|-------|---------------------------------------|-------------------------------------|
| viii) | Non-return valves:                    | Stainless steel spring loaded type. |
| ix)   | Blow off valve:                       | Stainless steel.                    |
| x)    | Unloading Cylinder header:            | Aluminium                           |
| xi)   | Tube of Blow off cooler / oil cooler: | SS 304                              |
| xii)  | Outer casing of coolers:              | Carbon Steel                        |
| xiii) | Gear box:                             | Cast Iron                           |
| xiv)  | Gears:                                | Alloy Steel.                        |

However, Material of Construction of components of Screw Compressor of reputed manufacturer shall also be acceptable subject to BHEL/Customer's approval.

#### Accessories

Each compressor skid to include Suction filter, silencer, intercooler & After-cooler with moisture separators, automatic drain traps, instruments, control panel Base plate, coupling guard. Foundation bolt, nuts, anti-vibration pads, Eye bolts and operation and maintenance tools.

#### Control Philosophy

Each compressor be operatable under continuous, auto, "Load-Unload" or "On-Off" mode (i.e.) "Dual control modes".

Any of the compressors shall be selectable at control panel to operate either for Base duty (Auto Load-Unload) or Standby duty (Auto On-Off) operation.

In "Base duty" mode, whenever air supply from compressors exceeds the demand, control system shall:

- i. Operate the load-unload circuit at a predetermined set pressure.
- ii. Throttle the inlet valve.
- iii. Open the blow off valve.



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Unloaded compressors to run in idling mode and when system pressure drops due to more demand, the load-unload circuit shall operate again to bring the compressor to 100% load after closing the blow-off valve.

When the pressure in the system rises to pre-set high value, the compressor shall be unloaded and shall run in idling mode for a specific period, (set by a timer), the compressor may be loaded to; full load in case of drop in system pressure or compressor may be stopped in case the system pressure does not drop and compressor continues to idle for more than a pre-set time.

The pressure and duration of time to be set shall be adjustable at site from the panel.

Further all interlocks for safe and proper operation of the compressors shall be provided by the Bidder.

All pressure and temperature conditions used for tripping the compressor shall be provided with pre-trip annunciation in the control panel.

Independent switches shall be used for alarms (annunciations) and tripping or interlock as far as possible.

An electrically operated automatic valve shall be provided on cooling water supply line of each compressor which will automatically shut off the cooling water supply, in case compressor is not running for more than set time duration. Suitable interlock shall also be provided for opening the valve before starting of the compressor.

**Intake Filter and Silencer**

Intake Air Filter and Silencer shall be comply with the following requirements:

**Performance**

- i. Filtering efficiency minimum 99% down to 10 microns.
- ii. Maximum pressure drop across filter at design flow rate in new condition be 250 mm of water column.
- iii. Design Airflow rate corresponding to compressor airflow.

**Quantity: One per compressor**

**Design air data**

- i. Dust concentration: 30 mg / M<sup>3</sup>
- ii. Particle size in microns: Up to 10 microns

**Type/Design: Heavy duty type construction**

- i. To provide densely packed, replaceable type paper as filtering media.
- ii. Filter to be designed to have sound suppressing characteristics.
- iii. Preferably Filter and silencer be combined type.
- iv. Filter to take suction from outside not from compressor room.



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**Inter Cooler & After Cooler**

Inter cooler and After-cooler shall comply with the following requirements:

**Performance**

- i. Outlet temperature of air from intercooler to suit the equipment offered.
- ii. Outlet temperature of air After-cooler to be limited to 10 Deg. C of inlet cooling water temperature.

**Type: Shell and tube type construction**

- i. Design code: TEMA class "C" or equivalent.
- ii. With removable tube bundle type.
- iii. With internal baffling.
- iv. Design pressure in airside: 2 Kg / Cm<sup>2</sup> more than air inlet pressure.
- v. Design pressure in waterside: Not less than shut off head of DM cooling water pump.

**Material**

- i. Tube : SS 304.
- ii. Shell : SA 285 Gr.C or equivalent
- iii. Tube sheet: SA 285 Gr.C or equivalent
- iv. Baffle : Carbon steel
- v. Flanges : Steel IS 2062.

**Accessories**

- vi. To provide necessary vent & drain connections.
- vii. Moisture separation units with level gauge.
- viii. Automatic drain-trap stations with bypass & isolating valves for moisture separators.
- ix. Safety valves
- x. Lifting eye bolts, tools & tackles if any.

**4.0 Instrumentation and Accessories:**



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Detailed specification for the Instrumentation shall be referred in the control and instrumentation section of this volume.

The bidder shall include instruments / controls to facilitate safe, reliable and efficient operation for the system offered. The instrumentation control system offered by the bidder shall be subjected to approval of the Employer during detailed engineering.

All Instrumentation and Control equipment required for Compressed air system such as primary and secondary instruments, control panels / cabinets, cable etc. shall meet the requirements specified in control and instrumentation section of the Volume.

The protection and interlock system shall be subject to the approval of the Employer.

All pressure and temperature conditions used for tripping the compressor shall be provided with pre-trip annunciation in the control panel.

Following general philosophy shall be followed regarding instrumentation.

**Pressure Indicators / Vacuum gauge:**

- i. At inlet outlet of each compression stage (air line).
- ii. At inlet and outlet of cooling water header.
- iii. At inlet and outlet of (air line) each heat exchangers of compressors.
- iv. At each air receiver and at outlet header of compressor
- v. At inlet of each of the filters of compressors assembly.

**Pressure Switches (Individual for each function).**

- i. At inlet/outlet of each compressor stage of the compressor (for annunciation / interlock).
- ii. At each air receiver for:
  - a) High/Low pressure alarm, for start/stop control.
  - b) For load/unload control.
  - c) At common discharge outlet of compressor & air drying plant (for alarm)
  - d) At discharge of each compressor.

**Temperature Indicators**

- i. At inlet and outlet of each heat exchangers / coolers of compressor in the lube oil, air & cooling water circuits.
- ii. At inlet and outlet of each adsorber vessel.
- iii. At common discharge outlet of compressor

**Temperature Switches / Temperature Controllers**

- i. At inlet and outlet of each heat exchangers / coolers of compressor in the air & cooling water and lube oil circuits for low & high alarms, trip & interlock.
- ii. At discharge of each compressors (before air receiver).
- iii. At common discharge outlet of air compressors



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**5.0 INSPECTION & TESTING**

- 5.1 The manufacturer shall conduct all tests to ensure that the equipment finished shall conform to the requirements of this specification and in compliance with requirements of applicable codes & standard.
- 5.2 All materials used for conveying air compressor and drive shall be of tested quality. Materials shall be tested as per the relevant standards and test certificates shall be made available to the purchaser.
- 5.3. Test at Shop:
- a) All pressure parts shall be subjected to hydraulic testing at a pressure or 150% of design pressure for a period not less than one (1) hour.
- b) Pneumatic test at design pressure shall also be carried out.

**6.0 PAINTING**

- 6.1 All parts of air compressors with drive shall be painted as per the specification furnished elsewhere.
- 6.2 Before transportation of the equipment necessary cleaning, flushing etc, shall be done shop coats of rust inhibiting paints, lacquers etc., shall be applied to various parts as necessary.

**CONVEYING AIR COMPRESSOR (Non lubricated Reciprocating)****2.0 CODES & STANDARDS:**

- 2.1 The design, manufacture, inspection & testing of air compressor as specified hereinafter shall comply with the requirements of the latest applicable Indian / British American Standards. The following standards/codes shall be following in particular.
- i) IS:5456 - Code of practice for testing pf positive displacement type air compressors and exhausters.
- ii) IS:5727 - Glossary of terms relating to compressors and exhausters.

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- iii) IS:6206 - Guide for selection, installation and maintenance of air compressors.

2.2 The material of various components shall conform as specified in Data Sheet-A, and where not specified, the material shall conform to the applicable IS / BS / ASTM / DIN Standards.

2.3 In case of any conflict between the above mentioned standards / codes and specification, the stipulations in the technical specification shall prevail. In case of any further conflict the same shall be referred to purchaser's engineer for clarification whose decision shall be final & binding.

### 3.0 **DESIGN AND CONSTRUCTION**

3.1 Air Compressors of reciprocating or rotary (screw) type shall be designed for continuous operation to satisfy the conveying air requirement for fail safe operation.

3.2 The design, manufacture and performance of air compressors shall comply with the requirements of latest applicable Indian / British American / DIN standards.

3.3 The compressors shall be water cooled, non-lubricated type along with all accessories as specified in the data sheet - A. Intercoolers/ aftercoolers, if provided, shall also be of water cooled, shell – tube construction.

3.4 The compressors shall be designed to ensure trouble free operation with min. vibration and noise. Multiple cylinders, if employed, shall be arranged in such a way as to ensure min. unbalance.

3.5 The wall thickness of the compressor cylinder shall be selected to withstand highest internal pressure and at the same time shall allow a number of re-borings.

3.6 The crank case shall be provided with oil level dip stick, breather and drain plug.

3.7 Any oil adhering to the piston rod shall be wiped-off by suitable wiper ring, suitable coolers shall also be fixed on the piston rod between the packing and wiper rings so that any trickling oil flow can be stopped from moving towards the cylinder.

3.8 Suction and discharge valves shall be suitable for quick opening and closing in conformity with the rotating speed of the crank shaft. Valves shall have large effective areas permitting low air velocity along with cushioning arrangement to minimise shock. Valve discs shall be of stainless steel (containing 15% or more chromium) heat treated, tempered and ground. The valve seats, guides & springs shall be of hardened stainless steel.





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- 3.11 Crankshaft, crank pin piston pin bearings shall be of antifriction or journal type depending on manufacturer's standard practice.
- 3.12 Splash or forced feed type of lubrication shall be provided for all bearings and sliding components.
- 3.13 The air receiver shall be sized that even in the event of total stoppage of air flow from the compressor; operation of conveying is not stopped for 2 cycles time duration.
- 3.14 Drive motor shall be connected to the air compressor directly or through V-belt or any other suitable type of power transmission system as specified in the data sheets. Shafts should be coupled through heavy-duty flexible coupling in case of direct drive.
- 3.15 The power rating of the drive shall be selected such that a min. margin of 15% is available over the total input power required at compressor drive shaft at the rated condition. Total input power shall include air compression power plus any power consumed in auxiliaries etc., (if any), when the driver is not directly coupled to compressor, due account shall be made for losses in power transmission in addition to the above 15% extra margin.
- 3.16 **MATERIAL OF CONSTRUCTION**

The material of construction for various parts of package air compressors shall be as follows:-

- |    |                             |   |                                   |
|----|-----------------------------|---|-----------------------------------|
| a) | Compressor cylinder         | : | CI, IS- 210, grade FG-260         |
| b) | Piston                      | : | Aluminum                          |
| c) | Piston rod                  | : | EN-8 as per BS -970               |
| d) | Connecting rod              | : | Forged steel as per IS-1875 CI IV |
| e) | Piston ring                 | : | Teflon with 25-30% carbon.        |
| f) | Crank case                  | : | CI, IS-210 Grade FG-260           |
| g) | Suction and delivery valves | : | S.S as per EN-56 of BS-970        |
| h) | Air receiver                | : | MS as per IS (2062)               |
- i) **For other parts : As per latest IS/BS/ASTM/AIS/ equivalent standards depending upon the parts**

3.17.0 **Instrumentation and Accessories:**

The conveying air compressor and drive shall be supplied completed with the following instrumentation and accessories as minimum.

- a) Discharge air pressure gauge
- b) Pressure switch to control actuation of compressor drive motor.



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- c) Starter for drive motor.
- d) Pressure relief valve
- e) Drain valve
- f) Delivery valve

**4.0 INSPECTION & TESTING**

- 4.1 The manufacturer shall conduct all tests to ensure that the equipment finished shall conform to the requirements of this specification and in compliance with requirements of applicable codes & standard.
- 4.2 All materials used for conveying air compressor and drive shall be of tested quality. Materials shall be tested as per the relevant standards and test certificates shall be made available to the purchaser.
- 4.3. Test at Shop:
  - a) All pressure parts shall be subjected to hydraulic testing at a pressure or 150% of design pressure for a period not less than one (1) hour.
  - b) Assembled receiver shall be hydraulically tested at 150% of the design pressure and the test pressure shall be maintained for at least 30 minutes. All joints shall be gently hammered during the test.
  - c) Pneumatic test at design pressure shall also be carried out.

**5.0 PAINTING**

- 5.1 All parts of air compressors with drive shall be painted as specified in Data Sheet-A or as per the specification furnished elsewhere.
- 5.2 Before transportation of the equipment necessary cleaning, flushing etc., shall be done shop coats of rust inhibiting paints, lacquers etc., shall be applied to various parts as necessary.



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**1.0 GENERAL**

This specification covers the PURCHASER'S general requirement of design, materials, constructional features, manufacture, inspection and testing at VENDOR'S works and/or his sub vendor's works of Denseveyor, and accessories specified hereinafter.

**2.0 CODES AND STANDARDS**

**2.1 The design, material, construction, manufacture, inspection and performance of the Transporter and accessories, shall comply with all statutory regulations and safety codes currently applicable in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable Indian/British/USA/DIN Standards.**

**2.2** The material of construction and other works of the Transporter and accessories shall in general conform to the following standards/codes but will be subjected to any modification and requirement as specified in Section C of Technical Speciation.

- i) Transporter Vessel – Mild Steel to IS 2062 (Gr. A min); Construction as per IS-2825 / BS5500/ASME SEC-VIII, Div-1
- ii) Material Handling Valve – As indicated in Sec-C of the specification
- iii) Flange – MS as per ANSI B 16.5

**2.3** Where the above standards are in conflict with the stipulations of this specification, this specification supersedes them. In case of any further conflict in this matter, the decision of the Engineer will be final and binding.

**3.0 DESIGN REQUIREMENTS**

**3.1** The dense phase pneumatic conveying system shall be designed for low velocity for conveying of materials as indicated in Section C.

**3.2** The system shall consist of dome shaped vessels made of Carbon Steel complete with pneumatically operated dome/metering valves capable of closing through a solid head of material to make a pressure tight seal.

**3.3** The bottom of vessel shall have transition bend and a control air supply system to the side of the conveying vessel.

**3.4** Airtight seal system shall be provided between the transporter and the feeding point.

**3.5** Transporter shall be equipped with **air strainer** to prevent pipe scale /dirt from causing pressure regulator malfunctioning.



TITLE:

**TECHNICAL SPECIFICATION FOR  
CONVEYING VESSEL**

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- 3.6** Automatic drain filter and oil fog lubricator set shall be fitted into the air line to dome valve/metering valve for use with pneumatic controls.
- 3.7** Any air line stop valve fitted in the air supply line of transporter shall be of ball type to avoid any restriction to air flow, when open.

**4.0 CONSTRUCTIONAL FEATURES**

- 4.1** The transporter vessel shall be fabricated from mild steel plate to the design of vendor. The vessel shall be of welded structure and shall be provided with necessary supporting structure. The vessel shall be airtight/leak proof in fully assembled condition. Conveying vessel shall be designed and tested as per IS 2825 class-III vessel. Temperature of mill reject coming into the conveying vessel shall be considered as 200 °C. Conveying vessel shall be designed for a pressure 10% above the maximum pressure encountered in the vessel. The conveying vessel shall be constructed with tested quality mild steel plates. They shall withstand the abrasive & hot condition of the mill rejects and operating air pressure. The conveying vessel shall be supported independently on steel columns. The vessel shall have suitably located and adequately numbered air connections for supply of compressed air for conveying mill rejects through pipes to overhead bin.
- 4.2** Dome/Metering valve shall be of manufacturer's standard construction and will be easily openable and closeable type. All joints will be flanged with asbestos free or silicon rubber gaskets suitable for 200 °C.
- 4.3** All bends will be of long radius cast bends ( $R = 5D$ ). Conveying pipes will be of mild steel heavy duty type.

**5.0 TESTING AND INSPECTION**

- 5.1** The purchaser shall have free access to those parts of manufacturer's works which are concerned with the fabrication of the steel work and shall be afforded with all reasonable facilities at all stages of preparation, fabrication and trial assemblies for satisfying himself that the fabrication is being undertaken in accordance with the provisions of this specification
- 5.2** Should any structure or part of a structure be found not to comply with any of the provision of this specification, it shall be liable to rejection. No structure or part of the structure, once rejected shall be resubmitted for inspection/test except in cases where the purchaser or his authorized representative considers the defect as rectifiable defects which may appear during fabrication shall be made with the consent of and according to the procedure laid down by the purchaser, the purchaser may, at his discretion, check the test results obtained at the manufacturer's works by independent tests at the Government test house or elsewhere, and should not be found to be unsatisfactory shall be rejected. The costs of such tests shall be borne by the contractor.



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**5.3** Scope of inspection shall include but not limited to the following:

- i) Material used in the fabrication shall be with manufacturer's test certificate with proper correlation for physical properties and chemical analysis. In the absence of correlation actual tests shall be done.
- ii) Welders shall be qualified as per ASME Standard. Only qualified welders shall be employed for the fabrication purpose.
- iii) Electrodes shall be of makes approved by BHEL.
- iv) All fillet welds, root run and trial run of butt welds shall be subjected to visual dye penetrating test with no linear indication. Acceptable norm for dye-penetrating test shall be as per Appendix-8 of ASME SEC. VII Div. 1.
- v) Special tests like NDT as per relevant code will be carried out for fabrication items.
- vi) Chemical analysis and hardness tests of linear plates shall be carried out.
- vii) Dimension shall be maintained as per approved drawings.

**DATA SHEET**

S. No.	Parameter	Description
1	Quantity of material to be conveyed per hour by each denseveyor	800 Kg
2	Capacity of denseveyor envisaged	Adequately sized to meet above requirement
3	Air supply pressure available	Bidder to Decide
4	Any Cooling envisaged for dome valve & quantity of cooling water	Bidder to Decide
5	Distance over which material is to be conveyed	Refer Layout Drawings



TITLE:

**TECHNICAL SPECIFICATION FOR  
MILL REJECT BUNKER AND  
ACCESSORIES**

BHEL DOCUMENTS NO.: PE-TS-3: 6-160-A001

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**1.0 GENERAL**

- 1.1 This specification covers the PURCHASER'S general requirement of design, manufacture, fabrication, assembly, inspection, testing and delivery to site or mill reject bunker and accessories specified.

**2.0 CODES AND STANDARDS**

- 2.1 The design, material, construction, manufacture, inspection, testing and performance of the mill reject bunker shall comply with all statutory regulations and all safety codes currently applicable in the locality where the equipment will be installed.
- 2.2 The material of construction and other works of the mill reject bunker shall in general conform to the following standards /codes but will be subject to any modification and requirements as specified in data sheet A of Section-D.
- |    |  |   |                    |
|----|--|---|--------------------|
| a) | Structural steel   | : | IS-2062 Gr A (min) |
| b) | Rolled Steel Beams, Channels and<br>Angle Sections   | : | IS-808             |
| c) | Scheme of Symbols for Welding  | : | IS-813             |
| d) | Covered Electrodes for Metal Arc<br>Welding of Structural Steel                                  | : | IS-814             |
| e) | Code of practice for use of Metal Arc<br>Welding for general Construction in<br>Mild Steel       | : | IS-816             |
| f) | Code of practice for inspection of Welds   | : | IS-822             |
| g) | Code of practice for use of structural<br>steel in general building construction                 | : | IS-800             |
| h) | Dimension for steel plate, sheet and<br>Strip for structural and general<br>Engineering purposes | : | IS-1730            |
| i) | Recommendation for metal arc welding   | : | IS-9575            |
- 2.3 Where the above standards are in conflict with the stipulations of this specification, the specification supercedes them. In case of any further conflict in this matter, the decision of the ENGINEER shall be final binding.



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**3.0 DESIGN REQUIREMENT**

- 3.1 The coal mill reject bunker shall be fabricated of mild steel plate with adequate stiffeners welded on. The bunker shall be supported on the concrete foundation provided by the purchaser. Foundation bolts, gratings etc. shall be provided by the bidder.
- 3.2 The reject bunker shall be complete with twin sector discharge gate, stainless steel liners, flanged connections, platforms, gratings/chequered plates, access staircase, hand railings etc. The equipment shall be designed and equipped for outdoor operation, complete with all accessories.

**4.0 CONSTRUCTIONAL FEATURES**

- 4.1 The bunker shall be of welded structure and shall be provided with necessary supporting structure. Flanged opening shall be provided at the bottom of the bunker for attaching the twin sector gate. The inclined part of the bunker shall be designed with a valley angle of not less than 60 deg. To the horizontal. The design of the bunker shall be such that the problem of formation of arch is eliminated. The inside surface shall be provided with liner MOC as specified elsewhere in the specification. Explosion diaphragm/Pressure relief valve shall be provided to release air from the bunker in case pressure inside the bunker exceeds 1 .0 kg/cm<sup>2</sup>(g)
- 4.2 Vendor shall furnish all steel work required for support and access for operation and maintenance. This shall include platforms, grating/chequered plates, stairways, hand railings, base plates, foundation bolts etc. Purchaser will provide only the foundation with pockets. The bunker shall have shed over it and shall be provided with monorail & hoist for equipment handling.
- 4.3 The storage bunker shall be so arranged that any 10 ton capacity truck can be conveniently loaded under it by an operator standing on the platform. The bunker-supporting column shall be so spaced to have a clear road access of 5.0 m width & clear headroom of 5.5 m.
- 4.4 Access and platform shall be provided with 32 mm thick MS grating & 32 mm MS GI pipe hand railing.
- 4.5 The storage bunker shall be provided with filter bags as specified elsewhere in the specification. Filter bags shall be suitably treated to minimize the chances of filter catching fire. It shall be possible to plug opening for damaged bag filters, if any, to facilitate un-interrupted operation. Suitable explosion vents shall be provided for the bag filter unit. Sequential cleaning cycle shall be initiated with pressure drop signal across the bag filter once sufficient cleaning air pressure is available. Solenoid/pneumatic valves shall be provided for this purpose. Bag cleaning mechanism shall be automatic and



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shall comprise of solenoid valves. Air nozzles shall be provided just above the filter to facilitate individual cleaning of each bag.

- 4.6 The terminal boxes for terminating reject conveying pipes shall be of steel construction with necessary deflector or impingement plate to take care of impact and wear due to high velocity reject particles discharging into the bunker.

**5.0 INSPECTION AND TESTING**

- 5.1 The purchaser shall have a free access at all reasonable times to these parts of manufacturer's works which are concerned with the fabrication of the steel work and shall be afforded all reasonable facilities at all stages of preparation, fabrication and trial assemblies for satisfying himself that the fabrication is being undertaken in accordance with the provisions of this specification.
- 5.2 Should any structure or part of a structure be found not to comply with any of the provisions of this specification, it shall be liable to rejection. No structure or part of structure, once rejected shall be resubmitted for inspection/ test except in cases where the purchaser or his authorized representative considers the defect as rectifiable. Defects which may appear during fabrication shall be made good with the consent of and according to the procedure laid down by the purchaser. The purchaser may, at his discretion, check the test results obtained at the manufacture's works by independent tests at the government test house or elsewhere and should the material so tested be found to be unsatisfactory shall be rejected. The cost of such tests shall be borne by the contractor.
- 5.3 Examination of material of construction, verification, correlation and identification with material test certificate.
- 5.4 Ensuring that the relevant weld procedure and welder qualifications tests are in accordance with fabrication code.
- 5.5 Inspection during fabrication at appropriate stage including fit up. Witness of dye penetrant testing at root and final run for all groove welds and final run for fillet welds as per ASTM E 165. All surfaces examined shall be free of:
- a) Relevant linear indications (Linear indications are those indications in which length is more than three times the width and only indication with major dimension greater than 1.6 mm shall be considered relevant).
  - b) Four or more rounded defects in a line separated by 1.6 mm or less (edge to edge). Rounded indications are those where length less than three times the width.
- 5.6 Any other tests as specified in the fabrication code.





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5.7 Dimensional check match marking as per approved drawings.

**6.0 SCOPE OF INSPECTION FOR RACK AND PINION GATE**

- 6.1 Examination of materials of construction, verification, correlation/testing and identification of material with test certificate for important items like body, drives, warm shaft, rack & pinion, wheel etc.
- 6.2 Dye Penetration check on drive shaft & warm shaft as per IS-3658 and there shall be no surface defects.
- 6.3 Dimensional check
- 6.4 For chain proof load shall be carried out.
- 6.5 Hardness of rubber component
- 6.6 Check for overall dimension, completeness, no load working after assembly.
- 6.7 Clearing, marking and painting.



TITLE:

**TECHNICAL SPECIFICATION FOR  
MILL DISCHARGE SPOUT & PYRITE  
HOPPER**

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**Mill Discharge Spout and Pyrite Hopper**

- Each coal mill has a discharge spout with a pneumatic cylinder operated knife gate valve for discharging rejects into a pyrite hopper of adequate capacity. This hopper shall serve to store the mill rejects between each operating cycle of dense phase system. Minimum effective storage capacity shall be 2-3 times the effective (batch capacity) of the conveying vessel.
- Each pyrite hopper shall be provided with a manually /pneumatically operated plate/ dome type valve of approved design at the bottom, adequately sized manhole/inspection door, impingement deflector plate, sizing grid and emergency chute with ~~manually~~ pneumatically operated Knife gate valve and reject quenching arrangement (water spray) shall be provided. Any platform/ structural support (as per IS 2062 Gr A/B) required to maintain the above equipment before pneumatically operated plate / dome valve. Necessary explosion vent (rupture disc with MOC SS 304/316) of proven design shall be provided in each pyrite hopper.
- Each emergency chute shall be provided with a ~~manually~~ pneumatically operated gate valve to transfer mill rejects from pyrite hopper to ground or to Owner's trolley. The gates shall be of robust construction and suitable for trouble free operation. The lever/gear wheel arrangement for manual operation shall be designed such that minimum effort is required to operate the gate. Necessary access and platform shall be provided. Limit switches shall be provided to indicate the valve position on control panel.
- Each pyrite hopper shall be provided with two level switches – one to start the operating sequence and the other to indicate the hopper above grid choked condition.
- Open/ Close Limit switches shall be provided in all manual and pneumatic KGVs and these limit switches shall be interlocked with MRS control system. Solenoid box cum local control panel shall be provided. Same shall house system start stop, vessel pressure indication, probe over ride, purge button so that system can be locally optd. It shall be possible to operate individual vessel from local pneumatic panel for few cycles in emergency.
- Following control modes shall be provided
  - Remote mode: System shall be controlled through MRS control System.
  - Local Mode:
    - a) Energized mode: Manual override shall be selected from MRS control System. System logic shall be executed in MRS control system itself.
    - b) De-energized mode: MRS control system shall be delinked and system (individual stack up assembly) shall be operated manually.



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- The sizing grid shall be provided inside the pyrite hopper to prevent oversized mill rejects, tramp iron etc. from entering the conveying vessel. The arrangement for collecting bigger pieces of coal rejects from the grid includes, among others, Knife Gate Valve, chute work etc. Bigger pieces of coal rejects shall roll down from the grid and through KGVs, chute work etc. Bigger pieces of coal rejects shall roll down from the grid and can be removed through the over sized seized reject removal gate (to be provided preferably at the bottom of inspection door) be discharged to Owners trolley. The arrangement shall be finalized during detail engineering. The grid shall be made of minimum 10 mm dia. M.S. bars IS with clear opening of 40 mm x 40 mm.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
**2X800 MW YERAMARUS TPS, KARNATAKA**

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## VOLUME-III



TITLE:  
**TECHNICAL SPECIFICATION  
2X800 MW YERAMARUS TPS, KARNATAKA  
COMPLIANCE CUM CONFIRMATION  
CERTIFICATE**

SPEC. NO.: PE-TS-3 I -160-A001  
VOLUME: III  
SECTION:  
REV. NO. 0 DATE 12-02-2013  
SHEET 1 OF 2

### **COMPLIANCE CUM CONFIRMATION CERTIFICATE**

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.

- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- h) The EQUIPMENT'S functional guarantees shall stand valid till at least eighteen (18) months from PERFORMANCE GUARANTEE test of equipment as per technical specification or commercial terms and conditions, whichever is later.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.
- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.



**TITLE:**  
**TECHNICAL SPECIFICATION**  
**2X800 MW YERAMARUS TPS, KARNATAKA**  
**COMPLIANCE CUM CONFIRMATION**  
**CERTIFICATE**

SPEC. NO.: PE-TS-3 I -160-A001  
VOLUME: III  
SECTION:  
REV. NO. 0 DATE 12-02-2013  
SHEET 2 OF 2

- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.



TITLE

**MILL REJECT HANDLING SYSTEM  
TECHNICAL SPECIFICATION  
MILL REJECT HANDLING SYSTEM  
DATA SHEET – B**

SPECIFICATION NO. PE-TS-3, (-160-A001)

VOLUME-III

SECTION

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OF

1

**S.NO DESCRIPTION****DATA/PARTICULARS**

- |     |   |   |
|-----|---|---|
| 1   | Type of pneumatic conveying system                      | : |
| 2   | System designed for Particle size and temp.             | : |
| 3   | Material and thickness of conveying vessel              | : |
| 4   | Size and material of vessel inlet valve                 | : |
| 5   | Type of conveying compressor offered                    | : |
| 6   | Compressor parameters (Nm <sup>3</sup> /min and kg/sqm) | : |
| 7.  | Air Receiver capacity and qty                           | : |
| 8   | System tonnage (TPH)                                    | : |
| 9   | Capacity of Vessel (Water filled cap.)                  | : |
| 10  | Cycle time of conveying vessel (sec)                    | : |
| 11  | Conveying velocity m/sec                                | : |
| 12  | Conveying Pipe size                                     | : |
| 13. | Air Booster offered, size and qty                       | : |
| 14. | Bag Filter – Type                                       | : |
| 15. | Bag filter material and temp suitability                | : |
| 16. | Air to Cloth Ratio                                      | : |
| 17. | Dust Emission rate at the outlet( mg/Nm <sup>3</sup> )  | : |
| 18. | Bunker Capacity and bunker plate thickness              | : |
| 19. | Bunker Liner material and thickness                     | : |
| 20. | Bunker Valley angle                                     | : |



TITLE

TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM

SPECIFICATION NO. PE-TS-3I I -160-A001

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### PRE-BID CLARIFICATION SCHEDULE

S. No.	Section/Clause /Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: \_\_\_\_\_

NAME: \_\_\_\_\_

DESIGNATION: \_\_\_\_\_

COMPANY: \_\_\_\_\_

DATE: \_\_\_\_\_

COMPANY SEAL





TITLE

TECHNICAL SPECIFICATION FOR  
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### TECHNICAL DEVIATION SCHEDULE

S.No.	Section/Clause/ Page No.	Description of Deviation	Reason/Remarks

The bidder hereby certifies that above mentioned are the only deviations from the technical specification for the subject package.

SIGNATURE: \_\_\_\_\_

NAME: \_\_\_\_\_

DESIGNATION: \_\_\_\_\_

COMPANY: \_\_\_\_\_

DATE: \_\_\_\_\_

COMPANY SEAL



TITLE

TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM

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**INSTRUMENT AIR REQUIREMENT\***

S. No.	Description	Requirement (m <sup>3</sup> / min & Pressure)	Intermittent/ Continuous
01			
02			
03			
04			
05			
06			

**SERVICE WATER REQUIREMENT\***

S. No.	Description	Requirement (m <sup>3</sup> / min & Pressure)	Intermittent/ Continuous
01			
02			
03			
04			
05			
06			

**EQUIPMENT WATER REQUIREMENT\***

S. No.	Description	Requirement (m <sup>3</sup> / min & Pressure)	Intermittent/ Continuous
01			
02			
03			
04			
05			
06			

\* Bidder shall furnish the instrument air, service water and equipment water requirement along with supporting calculation and reference document.

SIGNATURE:\_\_\_\_\_

NAME:\_\_\_\_\_

DESIGNATION:\_\_\_\_\_

COMPANY: \_\_\_\_\_

DATE:\_\_\_\_\_

COMPANY SEAL



TITLE

TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM

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### LIST OF START UP & COMMISSIONING SPARES

S.No.	ITEM DESCRIPTION	QUANTITY
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		

SIGNATURE:\_\_\_\_\_

NAME:\_\_\_\_\_

DESIGNATION:\_\_\_\_\_

COMPANY: \_\_\_\_\_

DATE:\_\_\_\_\_

COMPANY SEAL



TITLE

TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM

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### LIST OF SPECIAL MAINTENANCE TOOLS & TACKLES\*

S. No.	ITEM DESCRIPTION	QUANTITY
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		

\* Bidders need to fill this list ONLY IF the Tools are SPECIAL in nature.

SIGNATURE:\_\_\_\_\_

NAME:\_\_\_\_\_

DESIGNATION:\_\_\_\_\_

COMPANY:\_\_\_\_\_

DATE:\_\_\_\_\_

COMPANY SEAL



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### LIST OF RECOMMENDED SPARES FOR 3 YEARS OF TROUBLE FREE OPERATION

S. No.	ITEM DESCRIPTION	QUANTITY
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		

SIGNATURE:\_\_\_\_\_

NAME:\_\_\_\_\_

DESIGNATION:\_\_\_\_\_

COMPANY: \_\_\_\_\_

DATE:\_\_\_\_\_

COMPANY SEAL

2X800 MW YERAMARUS TPS, KARNATAKA - MILL REJECT SYSTEM									
SUGGESTIVE PRICE FORMAT									
S.No	Details of Works or Equipment/System	1 Ex-works price	2 ED	3 CST	4 FREIGHT	5=Sum(1 to 4) FOR SITE	6 E&C Charges	7 Service Tax on E&C	8=5+6+7 Total
1.1.0	<b>Lumpsum prices</b>								
1.1.1	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing, painting, supply/delivery duly packed at project site including freight , unloading, storage and handling at site, design & construction of structural and minor civil works at site etc.,erection and commissioning, trial run at site,PG Test and handing over to the customer of Complete Mill Reject System in line with drawings/documents/ test procedures approved by BHEL/Customer, inclusive of all prevailing taxes, duties and other levies for Mill Reject System complete with all accessories including erection and commissioning spares, maintenance tools and tackles as required for the total scope defined as per technical specification PE-TS-384-160-A001 taking into account all clarifications, confirmations and agreements till date.								
	<b>Notes:</b>								
a)	<b>Bidder to note that total price indicated above at 1.1.1 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed including electrical and control &amp; instrumentation.</b>								
b)	Any item not included in the price quoted above and shown separately will not be taken cognizance of and the offer shall be liable for rejection.								

2X800 MW YERAMARUS TPS, KARNATAKA - MILL REJECT SYSTEM									
SUGGESTIVE PRICE FORMAT									
S.No	Details of Works or Equipment/System	1 Ex-works price	2 ED	3 CST	4 FREIGHT	5=Sum(1 to 4) FOR SITE	6 E&C Charges	7 Service Tax on E&C	8=5+6+7 Total
1.2.0	Break - up of Prices given at 1.1.1 above.								
1.2.1	Lumpsum firm price for supply of denseveyors with dome /butterfly/ vertical swing type valve and accessories inclusive of all taxes, duties and other levies as applicable .								
1.2.2	Lumpsum firm price for supply of Pyrite hopper with level probes, temperature switch, rupture disc inclusive of all taxes, duties and other levies as applicable .								
1.2.3	Lumpsum firm price for supply of pneumatic panel/ Air control module/ Solenoid box with accessories inclusive of all taxes, duties and other levies as applicable								
1.2.4	Lumpsum firm price for supply of storage bunkers, pressure relief valves, bag filters with pressure switch , terminal boxes , level probes, chain pulley blocks with accessories inclusive of all taxes duties and other levies as applicable.								
1.2.5	Lumpsum firm price for air compressors with drive etc inclusive of all taxes, duties and other levies as applicable								
1.2.6	Lumpsum firm price for Air receivers with accessories inclusive of all taxes, duties and other levies as applicable								
1.2.7	Lumpsum firm price of pipes for Mill reject conveying, Compressed air & cooling water services etc inclusive of all taxes, duties and other levies as applicable								
1.2.8	Lumpsum firm price for Air & Water line valves inclusive of all taxes, duties and other levies as applicable								
1.2.9	Lumpsum firm price for pneumatically operated knife gate valves for different application inclusive of all taxes, duties and other levies as applicable .								
1.2.10	Lumpsum firm price for manually operated knife gate valves for different application inclusive of all taxes, duties and other levies as applicable .								
1.2.11	Lumpsum firm price for Alloy C.I bends/ fittings/laterals inclusive of all taxes, duties and other levies as applicable .								

2X800 MW YERAMARUS TPS, KARNATAKA - MILL REJECT SYSTEM								
SUGGESTIVE PRICE FORMAT								
S.No	Details of Works or Equipment/System	1 Ex-works price	2 ED	3 CST	4 FREIGHT	5=Sum(1 to 4) FOR SITE	6 E&C Charges	7 Service Tax on E&C
								8=5+6+7 Total
1.2.12	Lumpsum firm price for Field instruments/controls/special cables/ cable glands & lugs, cable trays inclusive of all taxes, duties and other levies as applicable .							
1.2.13	Lumpsum firm price of trolley mounted sump pump along with all its control, inclusive of all taxes, duties and other levies as applicable.							
1.2.14	Lumpsum firm price for Start-up & commissioning spares (Annexure I) as required inclusive of all taxes, duties and other levies as applicable							
1.2.15	Lumpsum price for special Maintenance tools and tackels as per Annexure II inclusive of all taxes, duties and other levies as applicable.							
1.2.16	Lumpsum firm prices of any other item under 1.2.1 inclusive of all taxes, duties and other levies as applicable ( please specify quoted items)							
	<b>Total of 1.2.1 to 1.2.17( Should match with 1.1.1). However , the break up prices indicated under this head are for internal use only &amp; NOT for any comparison purpose &amp; or making adjustment for scope variation.</b>							
<b>1.3.0</b>	<b>Unit Prices (To be used for adjustment against any scope variation and information)</b>							
1.3.1	Unit price per meter with erection/ laying of conveying air Pipes inclusive of taxes, duties & other levies etc. (bidder to indicate the pipe size also )							
1.3.2	Unit price per meter with erection/ laying of Mill Reject conveying Pipes inclusive of taxes, duties & other levies etc. (bidder to indicate the pipe size also )							
1.3.3	Unit price of pneumatically operated knife gate valve along with actuator,size 200 NB, inclusive of all taxes, duties and other levies as applicable (The price will include all associated accessories ie, solenoid, Limit switch required etc required)							
1.3.4	Unit price of manually operated knife gate valve (size 200 NB) inclusive of all taxes, duties and other levies as applicable							



2X800 MW YERAMARUS TPS, KARNATAKA - MILL REJECT SYSTEM									
SUGGESTIVE PRICE FORMAT									
		1	2	3	4	5=Sum(1 to 4) FOR SITE	6 E&C Charges	7 Service Tax on E&C	8=5+6+7 Total
S.No	Details of Works or Equipment/System	Ex-works price	ED	CST	FREIGHT				
1.4.0	<b>Optional price</b>								
1.4.1	Price for three years of recommended spares- inclusive of all taxes, duties and other levies as applicable . Bidder to furnish list in the format as per Annex-III along with item wise prices for adjustment purpose.								





2X800 MW YERAMARUS TPS, KARNATAKA - Mill Reject Handling System Mode: Pneumatic Conveying						ANNEXURE -III
Sl.No.	Description / Item	Working	Standby	Power Consumption (KW) (at motor input terminal)	Duty Factor	Total Power Consumption (KW)
1	2	3	4	5	6	7 = 3 x 5 x 6
1	Conveying Air Compressor	2	2		1.00	
Total KW						
Notes						
1 If the actual power consumption exceeds the guaranteed power consumption, liquidated damages shall be payable by the Contractor at the rate of 4.75 Lacs per KW excess power consumption, over the base guaranteed figure indicated by him in his bid. Such liquidated damages may be recovered by the Owner by deduction from the contract price or by enforcing the contract performance guarantee or in any other manner deemed fit by the Owner. For this purpose, the drives of standby equipment shall not be considered.						
2 Power consumption (KW) of air compressors shall be measured at motor input terminals when operating at the rated capacity and pressure and performed on test rig at the vendor's works and actual motor shall be used for this purpose.						
3 For bid evaluation purpose on account of guaranteed auxiliary power consumption, the same shall be loaded at the rate of 4.75 Lacs per KW for the differential power consumption.						
4 Base aux power figure is 69.5 KW at duty factor 1.00.						

2X800 MW YERAMARUS TPS, KARNATAKA - Mill Reject Handling System	ANNEXURE -IV
	<p data-bbox="571 1151 603 1227">VOID</p>



TITLE

**TECHNICAL SPECIFICATION FOR**  
**MILL REJECT HANDLING SYSTEM**

SHEET

SPECIFICATION NO. PE-TS-38I -160-A001

VOLUME - III

SECTION

REV 0

DATE

OF 11

**ANNEXURE-V****DRAWINGS/ DOCUMENTS TO BE SUBMITTED WITH THE BID**

Bidder shall submit the following drawings / documents along with their bid

- a) P&I Diagram
- b) Major process/equipment related details in the format given under Vol-III
- c) Utility requirement in the format given under Vol-III
- d) List of special maintenance tools & tackles, if any in the format given under vol-III.
- e) Copy of Electrical Scope between BHEL & Vendor duly stamped
- f) Electrical Equipment Specification for Mill Reject Handling System duly stamped
- g) Electrical load list
- h) **Deviation schedule** with reference to specific clauses of the specification along with reason for such deviation in the format given under Vol-III
- i) Un priced copy of price format indicating quoted/ not quoted against each row/column
- j) Copy of pre-bid clarifications, if any, duly signed & stamped
- k) Signed/Stamped copy of Compliance cum Confirmation Certificate (Vol-III)

OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSECE OF ANY OF ABOVE DOCUMENTS. P& I DIAGRAM TO BE FURNIHSED WITH THE BID WILL BE REVIED ONLY FOR UNDERSTANDING THE SCOPE OF WORK & OPERATION PHILOSPPHY. THIS SHALL BE FINALIZED DURING DETAIL ENGINEERING WITHOUT ANY COMMERCIAL/ DELIVERY IMPLICATION.

DOCUMENT OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.



TITLE

# **TECHNICAL SPECIFICATION FOR MILL REJECT HANDLING SYSTEM**

SPECIFICATION NO. PE-TS-38I -160-A001

VOLUME III

SECTION

REV 0

DATE 12-02-2013

SHEET 1 OF 3

## **ANNEXURE-VI**

### **DRAWINGS/ DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

Sl. No.	BHEL DRG.NO	DRAWING TITLE	REMARKS	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF LOI
1	PE-V0-381-160-A001	Quality Plans of Critical Items	APPROVAL	6
2	PE-V0-381-160-A101	DESIGN PHILOSOPHY OF MILL REJECT SYSTEM	APPROVAL	3
3	PE-V0-381-160-A305	G.A OF BUNKER	APPROVAL	6
4	PE-V0-381-160-A312	GA OF COMMON CONTROL PANEL FOR COMPRESSORS	APPROVAL	10
5	PE-V0-381-160-A318	OVERALL DIMENSIONAL & FOUNDATION DETAIL DRAWING (2 SHEETS)	APPROVAL	6
6	PE-V0-381-160-A501	P & I DIAGRAM OF MILL REJECT HANDLING SYSTEM	APPROVAL	4
7	PE-V0-381-160-A505	P & I DIAGRAM OF COMPRESSOR	APPROVAL	10
8	PE-V0-381-160-A801	CONTROL WRITE-UP	APPROVAL	8
9	PE-V0-381-160-A102	DATA SHEET OF DENSEVEYOR	INFORMATION	4
10	PE-V0-381-160-A103	DATA SHEET OF PYRITE HOPPER	INFORMATION	4
11	PE-V0-381-160-A104	DATA SHEET OF BUNKER DISCHARGE GATE	INFORMATION	4
12	PE-V0-381-160-A105	DATA SHEET OF TERMINAL BOX	INFORMATION	4
13	PE-V0-381-160-A106	DATA SHEET OF 200 NB PRESSURE RELIEF VALVE(DEAD WT.TYPE)	INFORMATION	4
14	PE-V0-381-160-A107	DATA SHEET OF PLATE VALVE	INFORMATION	8
15	PE-V0-381-160-A108	DATA SHEET OF BAG FILTER	INFORMATION	8
16	PE-V0-381-160-A109	DATA SHEET OF ACI BEND	INFORMATION	6
17	PE-V0-381-160-A110	DATA SHEET OF AIR COMPRESSOR	INFORMATION	10
18	PE-V0-381-160-A111	DATA SHEET OF LEVEL SWITCH	INFORMATION	10
19	PE-V0-381-160-A112	DATA SHEET OF METALLIC EXPANSION BELLOW	INFORMATION	8
20	PE-V0-381-160-A114	DATA SHEET OF CHAIN PULLEY BLOCK	INFORMATION	12
21	PE-V0-381-160-A115	DATA SHEET OF TEMPERATURE SWITCH	INFORMATION	10
22	PE-V0-381-160-A116	DATA SHEET OF SUMP PUMP	INFORMATION	10
23	PE-V0-381-160-A117	DATA SHEET OF MOTOR FOR DRAIN SUMP PUMP	INFORMATION	10
24	PE-V0-381-160-A301	GA OF DENSEVEYOR	INFORMATION	4
25	PE-V0-381-160-A302	G.A OF PYRITE HOPPER	INFORMATION	4
26	PE-V0-381-160-A303	GA & DATA SHEET OF AIR RECEIVER	INFORMATION	4
27	PE-V0-381-160-A304	GA OF BUNKER DISCHARGE GATE	INFORMATION	4
28	PE-V0-381-160-A306	GA OF TERMINAL BOX	INFORMATION	4
29	PE-V0-381-160-A307	GA OF 200 NB PRESSURE RELIEF VALVE	INFORMATION	4
30	PE-V0-381-160-A308	GA OF KNIFE GATE/PLATE VALVE	INFORMATION	8
31	PE-V0-381-160-A309	G.A OF BAG FILTER	INFORMATION	8
32	PE-V0-381-160-A310	GA OF ACI BEND	INFORMATION	8
33	PE-V0-381-160-A311	GA AND FOUNDATION DETAIL OF COMPRESSOR(3 SHEETS)	INFORMATION	10



TITLE

# **TECHNICAL SPECIFICATION FOR MILL REJECT HANDLING SYSTEM**

SPECIFICATION NO. PE-TS-38I -160-A001

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34	PE-V0-381-160-A313	R.F LEVEL SWITCH & SENSING PROBE (MODEL-550)	INFORMATION	10
35	PE-V0-381-160-A315	G.A. OF RUPTURE DISC.	INFORMATION	6
36	PE-V0-381-160-A316	GA OF CHAIN PULLEY BLOCK	INFORMATION	12
37	PE-V0-381-160-A317	G.A OF TEMPERATURE SWITCH	INFORMATION	10
38	PE-V0-381-160-A401	STRUCTURAL ARRANGEMENT OF BUNKER	INFORMATION	6
39	PE-V0-381-160-A402	DESIGN CALCULATION FOR BUNKER	INFORMATION	6
40	PE-V0-381-160-A403	LOAD DATA FOR BUNKER	INFORMATION	4
41	PE-V0-381-160-A404	TRENCH AND INSERT DETAIL OF MRS	INFORMATION	4
42	PE-V0-381-160-A502	EQPT LAYOUT OF MILL REJECT SYSTEM	INFORMATION	6
43	PE-V0-381-160-A503	PIPING LAYOUT OF MILL REJECT SYSTEM	INFORMATION	6
44	PE-V0-381-160-A504	PNEUMATIC CIRCUIT OF DENSEVEYOR 6/8/5 & PLATE VALVE	INFORMATION	8
45	PE-V0-381-160-A701	PIPING SCHEDULE	INFORMATION	8
46	PE-V0-381-160-A702	VALVE SCHEDULE	INFORMATION	8
47	PE-V0-381-160-A703	PAINTING SCHEDULE	INFORMATION	8
48	PE-V0-381-160-A704	I/O LIST	INFORMATION	10
49	PE-V0-381-160-A705	SIGNAL CABLE SCHEDULE	INFORMATION	12
50	PE-V0-381-160-A706	CONTROL CABLE SCHEDULE	INFORMATION	12
51	PE-V0-381-160-A803	CONTROL SCHEME FOR PLC PANEL FOR MRS	INFORMATION	12
52	PE-V0-381-160-A811	DATA SHEET OF SOLENOID VALVE	INFORMATION	10
53	PE-V0-381-160-A812	DATA SHEET OF PRESSURE SWITCH	INFORMATION	10
54	PE-V0-381-160-A813	DATA SHEET OF PRESSURE GAUGE	INFORMATION	10
55	PE-V0-381-160-A901	OPERATION AND MAINTENANCE MANUAL	INFORMATION	16

## **Notes:**

- The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
- Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
- Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
- Bidder to note that all values/dimensions/elevations etc. without supporting back up data adopted/assumed by the successful bidder (during contract stage) in the design calculation/drawings shall be taken by the customer/owner to be correct unless they are stipulated in the specification. Any problem arising later in this regard shall be made good by the successful bidder at his cost and no extension of time shall be granted for the same.
- All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:
  - All drawings and documents shall indicate the list of all reference drawings including general arrangement.
  - All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
  - Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.





TITLE

# **TECHNICAL SPECIFICATION FOR MILL REJECT HANDLING SYSTEM**

SPECIFICATION NO. PE-TS-38I -160-A001

VOLUME III

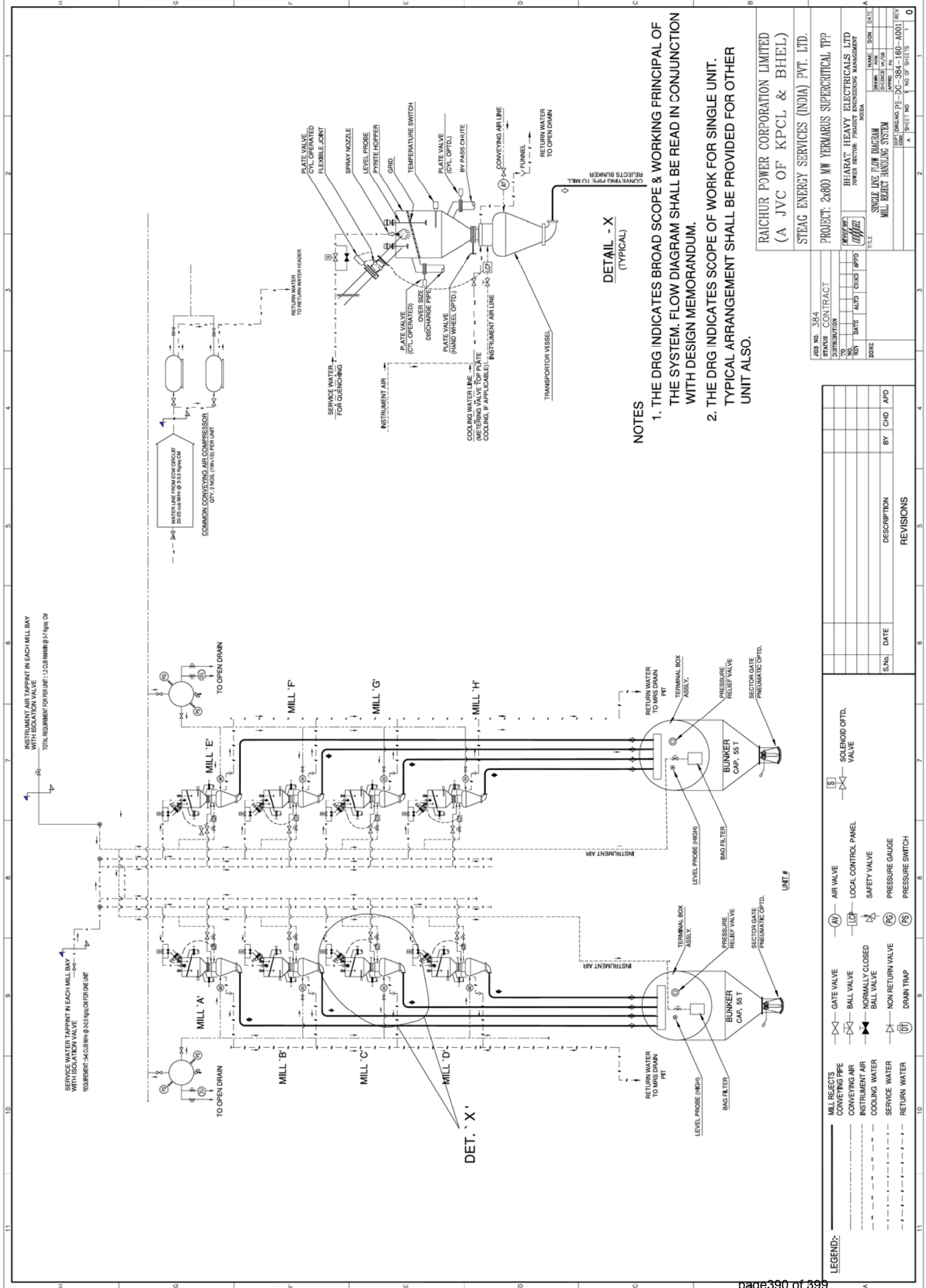
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REV 0

DATE 12-02-2013

SHEET 3 OF 3

- d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
- e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 ....etc.
6. Drawings and documents not covered above but required to check safety of machines/system, shall be submitted during detailed engineering stage without any commercial implication.
7. All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.
8. All drawings shall be prepared as per BHEL's title block and bear BHEL's drawing No.
9. Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
10. Bidder to follow the following the drawing submission schedule:
  - 1st submission of drawings from date of LOI as per the submission schedule.
  - Every revised submission incorporating comments – within 10 days.
  - Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.



NOTES

1. THE DRG INDICATES BROAD SCOPE & WORKING PRINCIPAL OF THE SYSTEM. FLOW DIAGRAM SHALL BE READ IN CONJUNCTION WITH DESIGN MEMORANDUM.
2. THE DRG INDICATES SCOPE OF WORK FOR SINGLE UNIT. TYPICAL ARRANGEMENT SHALL BE PROVIDED FOR OTHER UNIT ALSO.

**RAICHUR POWER CORPORATION LIMITED**  
**(A JVC OF KPCL & BHEL)**

**STEAG ENERGY SERVICES (INDIA) PVT. LTD.**

**PROJECT: 2x800 MW YERMAHUS SUPERCritical TPP**

**BEHARAT HEAVY ELECTRICALS LTD**  
POWER SECTOR: PROJECT ENGINEERING MANAGEMENT

**SINGLE UNIT FLOW DIAGRAM**  
MILL REJECT HANDLING SYSTEM

**STATUS CONTRACT**

**DISTRIBUTION**

**TO** **DATE** **BY** **CHKD** **APPD**

**ZONE**

**REVISIONS**

S.No.	DATE	DESCRIPTION	BY	CHKD	APPD

**REVISIONS**

**NO. OF SHEETS** **T** **0**









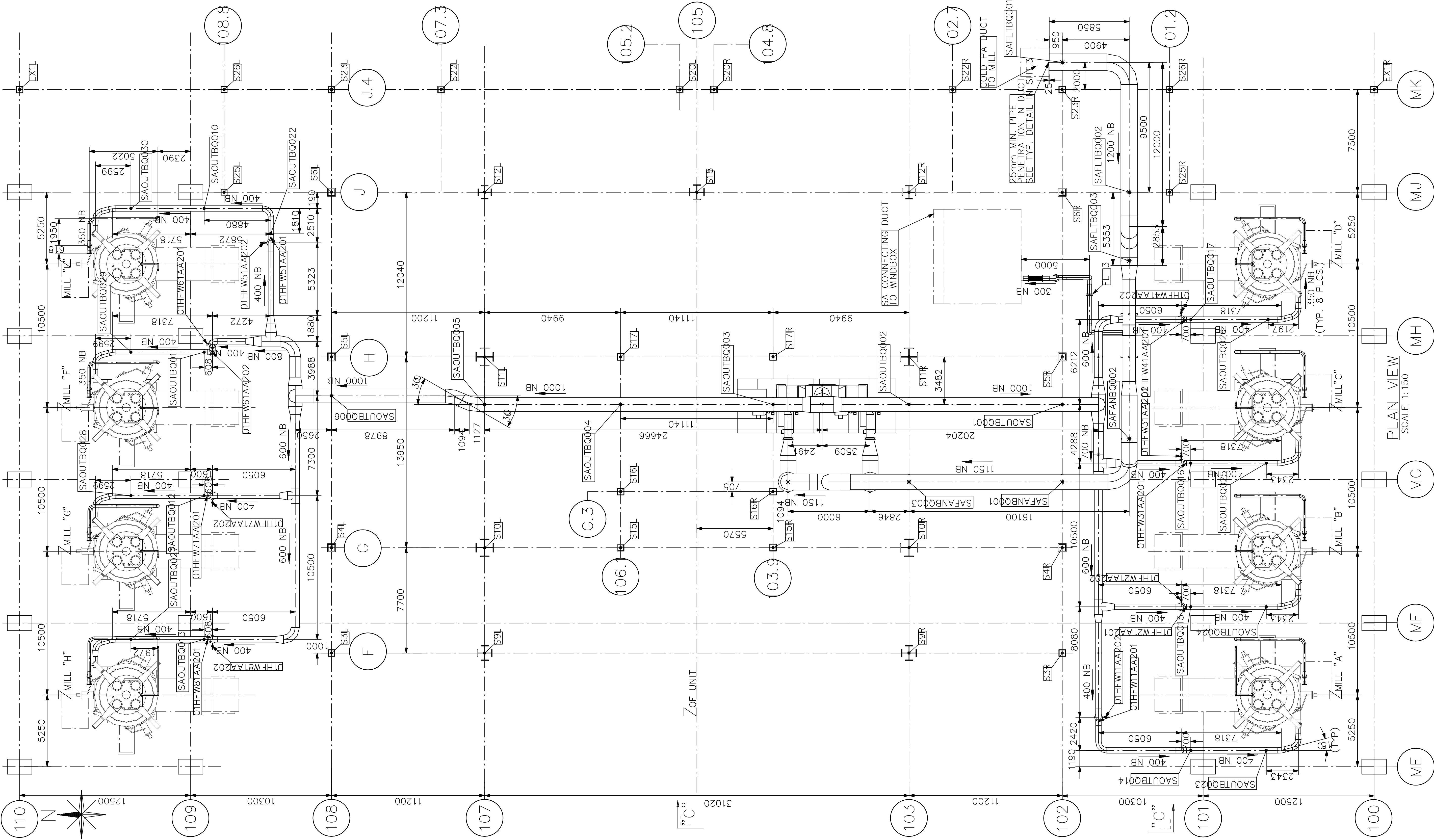






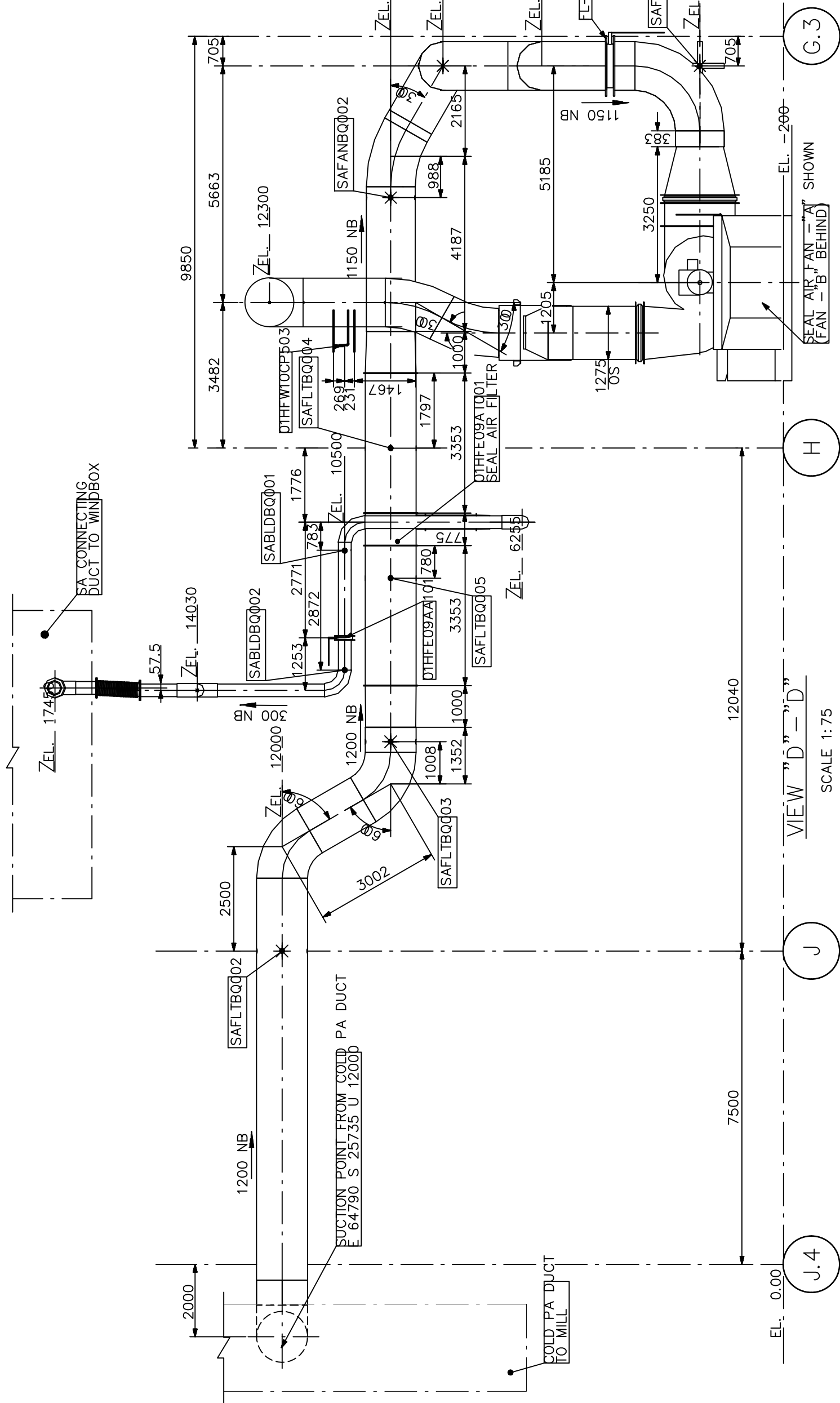
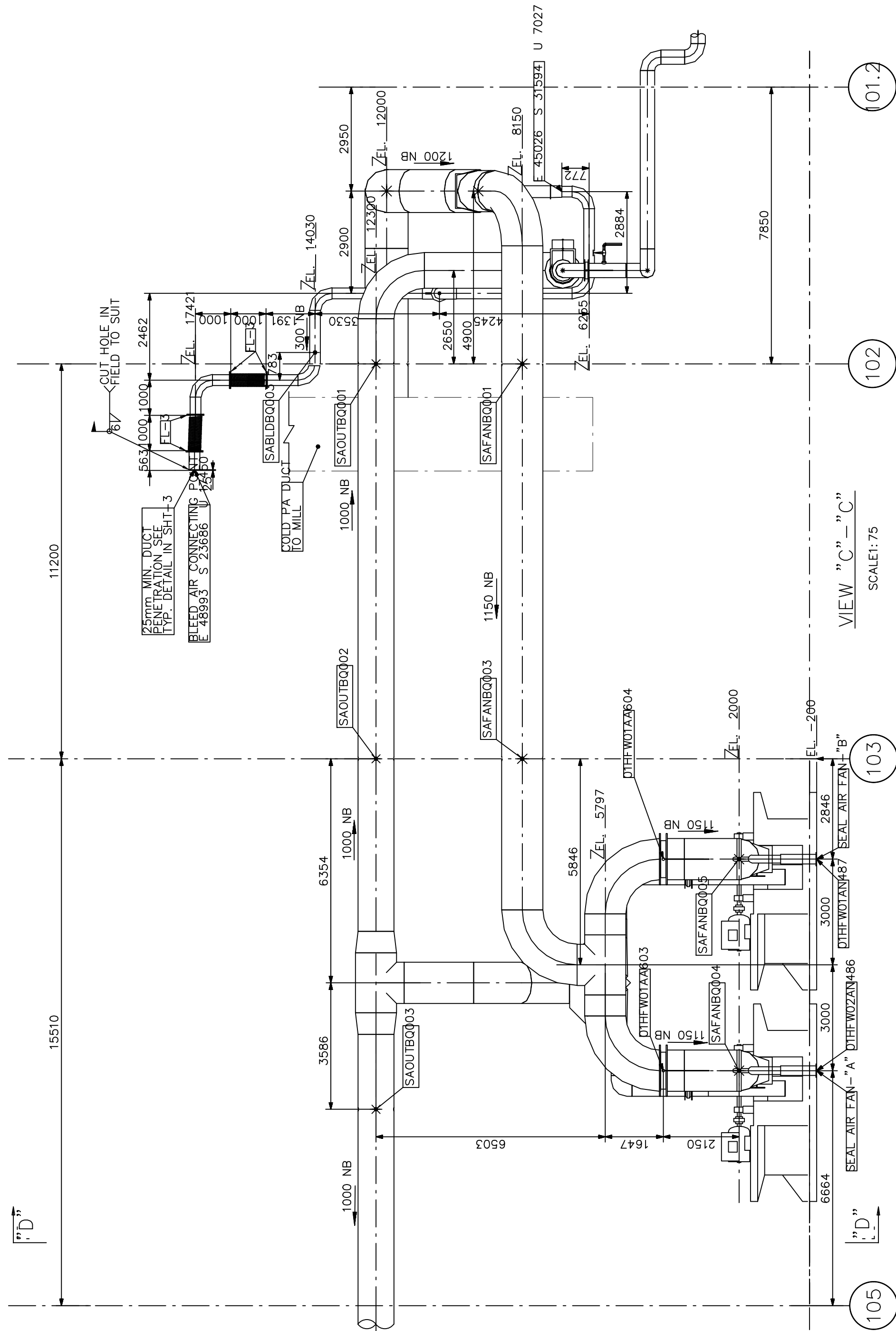






REFERENCE DRAWINGS:

- 1. P & ID FOR COAL FEEDER & PULVERIZER SYSTEM (1/2)
- 2. P & ID FOR COAL FEEDER & PULVERIZER SYSTEM (2/2)
- 3. HP 1103 BOWL MILL ARRGT. SHEET 1/2
- 4. HP 1103 BOWL MILL ARRGT. SHEET 2/2
- 5. GA DRAWING FOR SEAL AIR FAN
- 6. SEAL AIR PIPING SYSTEM ISOMETRIC SHT 1 OF 3
- 7. SEAL AIR PIPING SYSTEM ISOMETRIC SHT 3 OF 3



- 00310-1E8524
- 00310-1E8525
- E-PLVE-1218
- E-PLVE-1233
- 1-00-108-22053
- 0-47-686-02367
- 0-47-686-02369

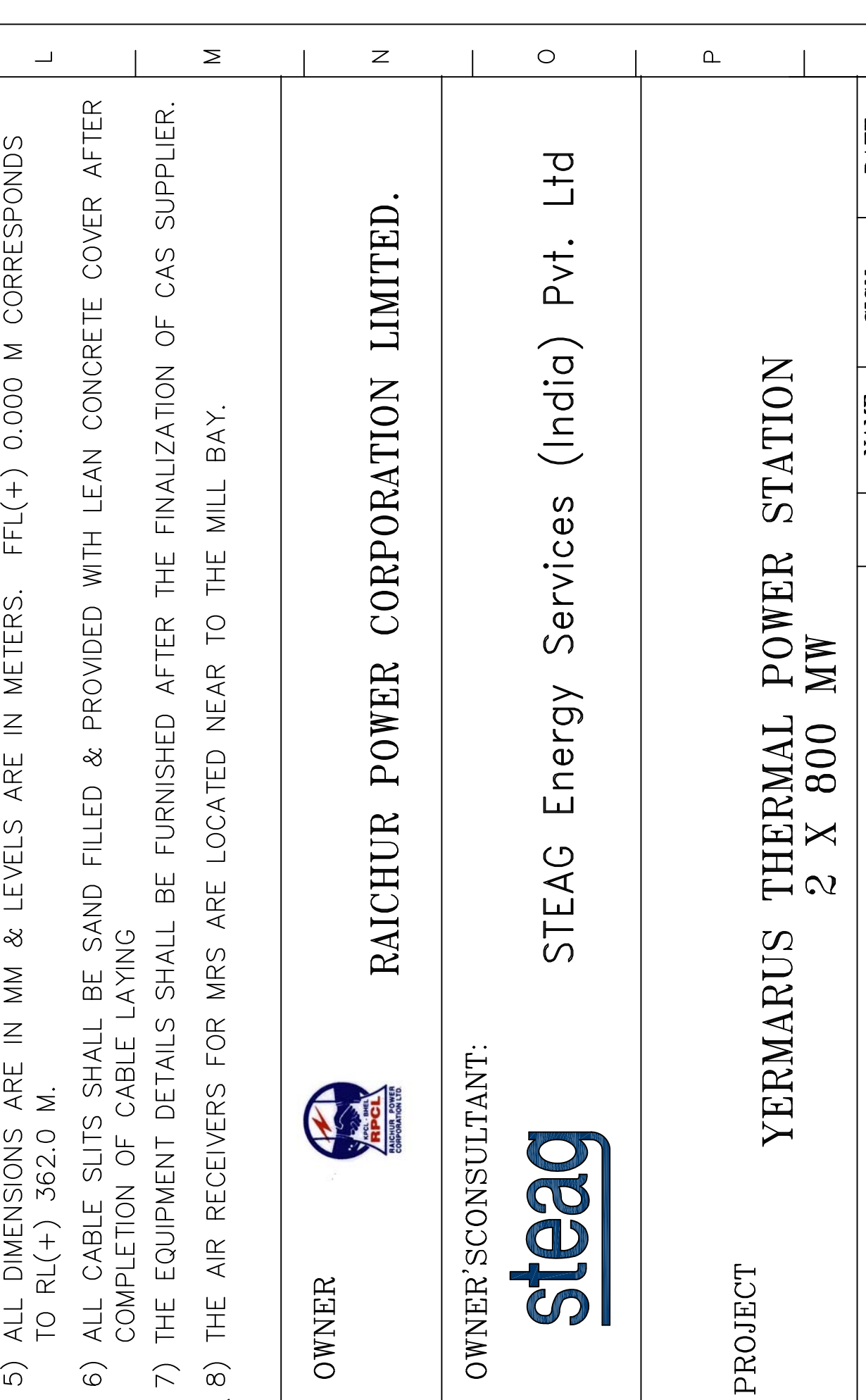
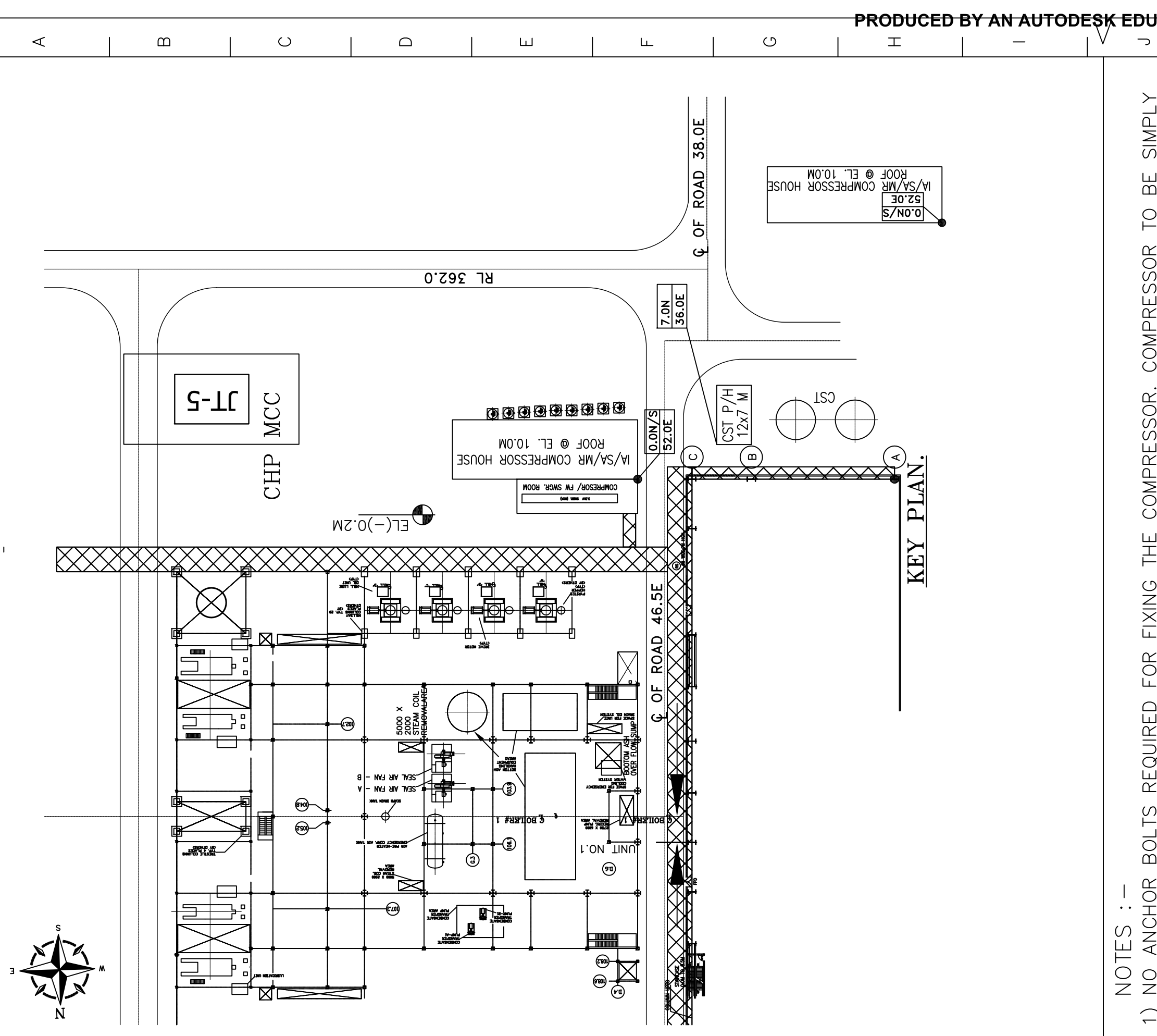
BHEL CUSTOMER NO. 1802 & 1803	
CUSTOMER	RAICHUR POWER CORPORATION LIMITED (A JVC OF KPCL & BHEL)
CONSULTANT	EVONIK ENERGY SERVICES (INDIA) LTD
PROJECT	YERAMARU THERMAL POWER PROJECT UNIT 1 & 2 -EACH OF 800MW CAPACITY YERMARAS, RAICHUR DIST., KARNATAKA
	BHARAT HEAVY ELECTRICALS LIMITED
	BOILER PLANT UNIT, TRICHURAPALLU - 620014
PROJECT NO.	0-47-686-02368
REV	00
DRAWN: VSS	DATE: 07.01.11
CHECKED: GSK	DATE: 07.01.11
APPROVED: MP	DATE: 07.01.11

SEAL AIR PIPING SYSTEM ISOMETRIC

SHEET 2 OF 3







NOTES : -

1) NO ANCHOR BOLTS REQUIRED FOR FIXING THE COMPRESSOR. COMPRESSOR TO BE SIMPLY

NOTES : -

1) NO ANCHOR BOLTS REQUIRED FOR FIXING THE COMPRESSOR. COMPRESSOR TO BE SIMPLY PLACED ON THE FOUNDATION.

2) NO UNBALANCED FORCES ARE BEING TRANSFERRED DOWN TO THE FOUNDATION BECAUSE OF NO DYNAMIC UNBALANCED FORCES FOR COMPRESSOR & DRYER.

3) FLANGES, COUNTER FLANGES WITH GASKET, NUTS & BOLTS AT ALL TERMINATING POINTS ARE IN CAS SUPPLIER SCOPE

4) CIVIL WORK, FABRICATION, GROUTING OF EQUIPMENT & PLACEMENT OF CHECKERED PLATE ETC. SHALL BE IN BHEL'S SCOPE.

5) ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METERS. FFL(+ ) 0.000 M CORRESPONDS TO RL(+ ) 362.0 M.

6) ALL CABLE SLITS SHALL BE SAND FILLED & PROVIDED WITH LEAN CONCRETE COVER AFTER COMPLETION OF CABLE LAYING

7) THE EQUIPMENT DETAILS SHALL BE FURNISHED AFTER THE FINALIZATION OF CAS SUPPLIER.

8) THE AIR RECEIVERS FOR MISCARE LOCATED NEAR TO THE MILL SHALL BE

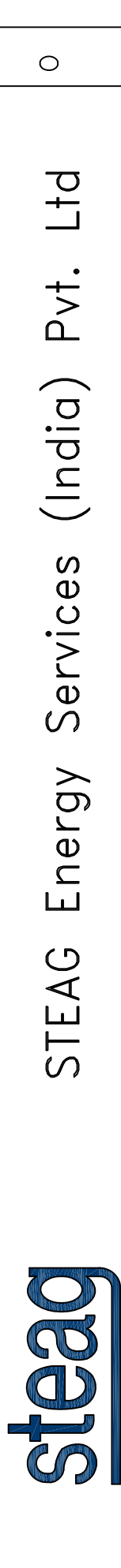
8) THE AIR RECEIVERS FOR MRS ARE LOCATED NEAR TO THE MILL BAY.	M
--	---

OWNER



 **NPCL**  
NATURAL GAS  
RAICHUR POWER CORPORATION LTD.

OWNER'S CONSULTANT:



**stead** STEAG Energy Services (India) Pvt. Ltd

PROJECT

PROJECT	YERMARUS THERMAL POWER STATION
	2 X 800 MW

[illegible]

COMPRESSOR HOUSE LAYOUT

TITLE		Q			
COMPRESSOR HOUSE LAYOUT		DRN	NAME APPD	SIGN.	DATE
		DESN	APPD		
		CHD	AA		
		APPD	CETD		28.02.2011

[illegible]







