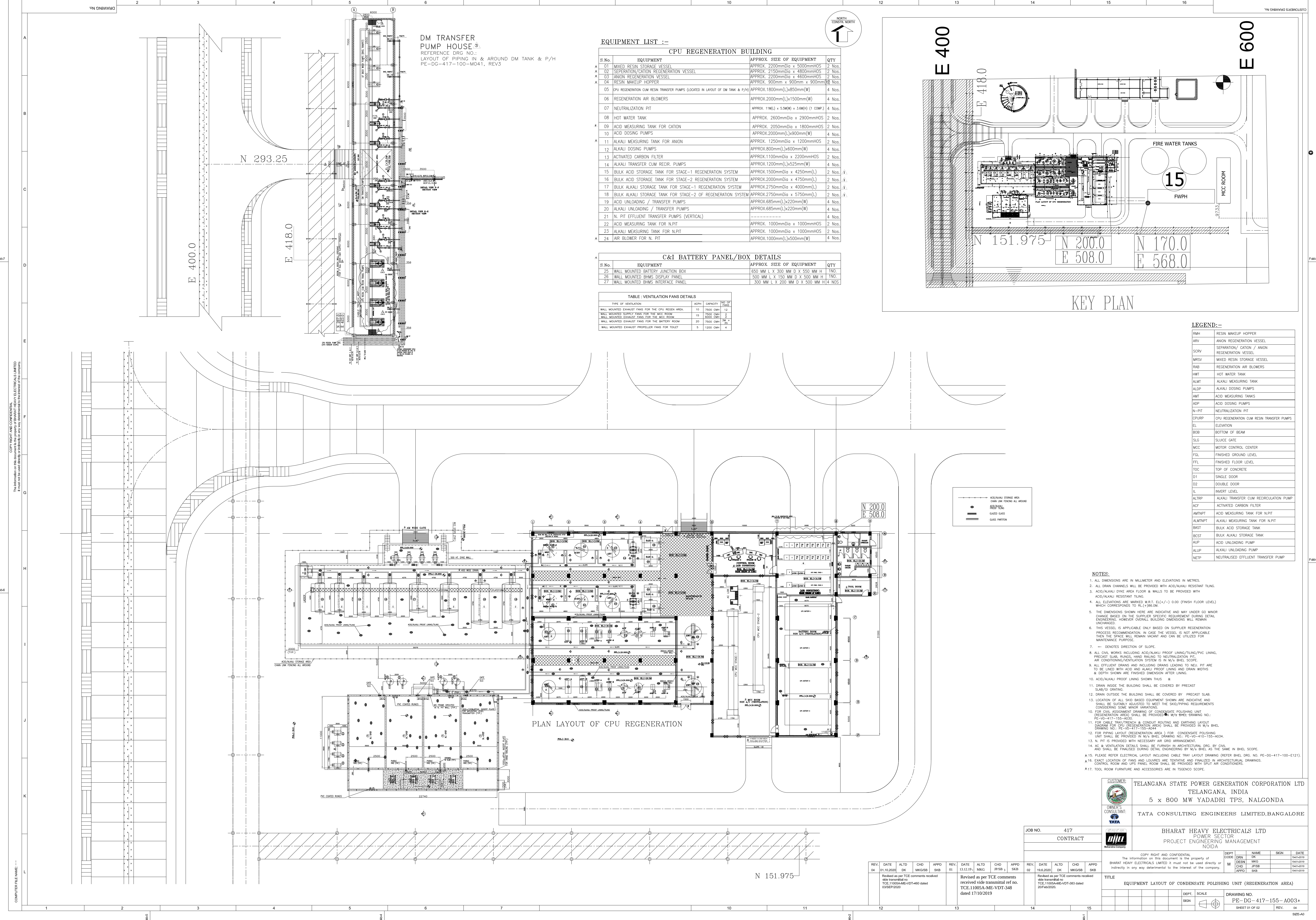
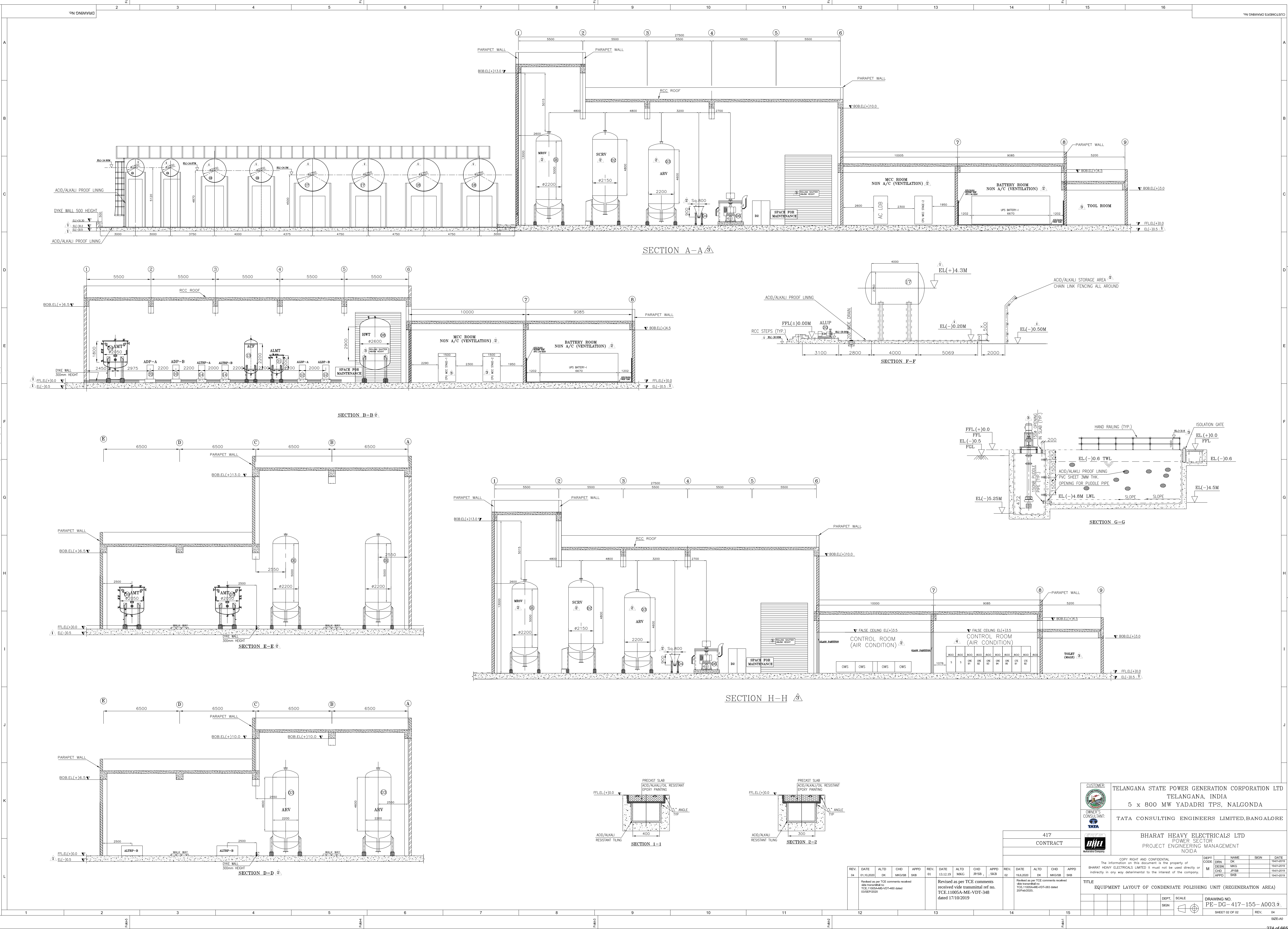




S.No.	EQUIPMENT	APPROX. SIZE OF EQUIPMENT	QTY
01	MIXED RESIN STORAGE VESSEL	APPROX. 2200mmDia x 5000mmHOS	2 Nos.
02	SEPERATION/CATION REGENERATION VESSEL	APPROX. 2150mmDia x 4800mmHOS	2 Nos.
03	ANION REGENERATION VESSEL	APPROX. 2200mmDia x 4600mmHOS	2 Nos.
04	RESIN MAKEUP HOPPER	APPROX. 900mm x 900mm x 900mm	2 Nos.
05	CPU REGENERATION CUM RESIN TRANSFER PUMPS (LOCATED IN LAYOUT OF DM TANK & P/H)	APPROX.1800mm(L)x850mm(W)	4 Nos.
06	REGENERATION AIR BLOWERS	APPROX.2000mm(L)x1500mm(W)	4 Nos.
07	NEUTRALIZATION PIT	APPROX. 11M(L) x 5.5M(W) x 3.6M(H) (1 COMP)	4 Nos.
08	HOT WATER TANK	APPROX. 2600mmDia x 2900mmHOS	2 Nos.
09	ACID MEASURING TANK FOR CATION	APPROX. 2050mmDia x 1800mmHOS	2 Nos.
10	ACID DOSING PUMPS	APPROX.2000mm(L)x900mm(W)	4 Nos.
11	ALKALI MEASURING TANK FOR ANION	APPROX. 1250mmDia x 1200mmHOS	2 Nos.
12	ALKALI DOSING PUMPS	APPROX.800mm(L)x600mm(W)	4 Nos.
13	ACTIVATED CARBON FILTER	APPROX.1100mmDia x 2200mmHOS	2 Nos.
14	ALKALI TRANSFER CUM RECIR. PUMPS	APPROX.1200mm(L)x525mm(W)	4 Nos.
15	BULK ACID STORAGE TANK FOR STAGE-1 REGENERATION SYSTEM	APPROX.1500mmDia x 4250mm(L)	2 Nos.
16	BULK ACID STORAGE TANK FOR STAGE-2 REGENERATION SYSTEM	APPROX.2000mmDia x 4750mm(L)	2 Nos.
17	BULK ALKALI STORAGE TANK FOR STAGE-1 REGENERATION SYSTEM	APPROX.2750mmDia x 4000mm(L)	2 Nos.
18	BULK ALKALI STORAGE TANK FOR STAGE-2 OF REGENERATION SYSTEM	APPROX.2750mmDia x 5750mm(L)	2 Nos.
19	ACID UNLOADING / TRANSFER PUMPS	APPROX.685mm(L)x220mm(W)	4 Nos.
20	ALKALI UNLOADING / TRANSFER PUMPS	APPROX.685mm(L)x220mm(W)	4 Nos.
21	N. PIT EFFLUENT TRANSFER PUMPS (VERTICAL)		4 Nos.
22	ACID MEASURING TANK FOR N.PIT	APPROX. 1000mmDia x 1000mmHOS	2 Nos.
23	ALKALI MEASURING TANK FOR N.PIT	APPROX. 1000mmDia x 1000mmHOS	2 Nos.
24	AIR BLOWER FOR N. PIT	APPROX.1000mm(L)x500mm(W)	4 Nos.

S.No.	EQUIPMENT	APPROX. SIZE OF EQUIPMENT	QTY
25	WALL MOUNTED BATTERY JUNCTION BOX	650 MM L X 300 MM D X 550 MM H	1 NO.
26	WALL MOUNTED BMS DISPLAY PANEL	500 MM L X 150 MM D X 500 MM H	1 NO.
27	WALL MOUNTED BMS INTERFACE PANEL	300 MM L X 200 MM D X 500 MM H	4 NOS

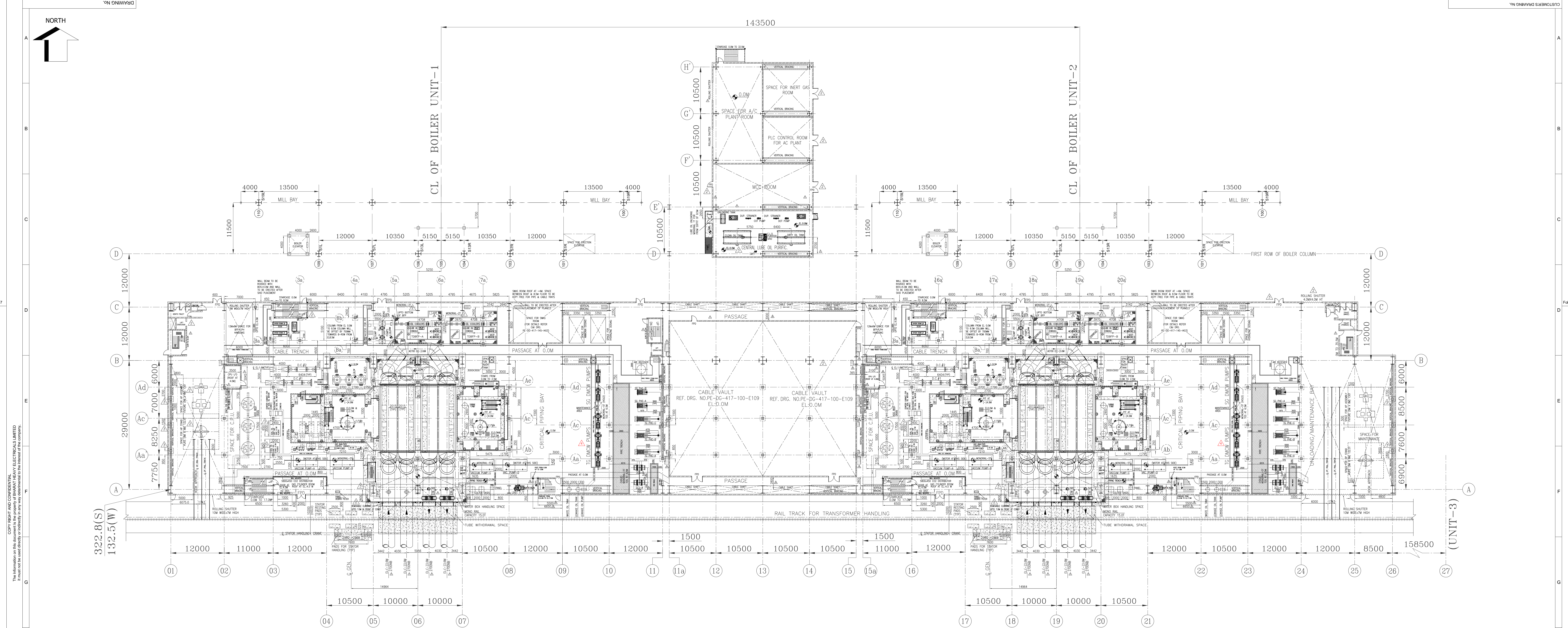
TABLE : VENTILATION FANS DETAILS			
TYPE OF VENTILATION	ACPH	CAPACITY	NO. OF FANS
WALL MOUNTED EXHAUST FANS FOR THE CPU REGEN AREA.	10	7500 CMH	12
WALL MOUNTED "SUPPLY" FANS FOR THE "MCC" ROOM.	15	7500 CMH	2
WALL MOUNTED EXHAUST FANS FOR THE MCC ROOM.	15	8500 CMH	2
WALL MOUNTED EXHAUST FANS FOR THE BATTERY ROOM	20	7500 CMH	2
WALL MOUNTED EXHAUST PROPELLER FANS FOR TOILET	5	1200 CMH	4



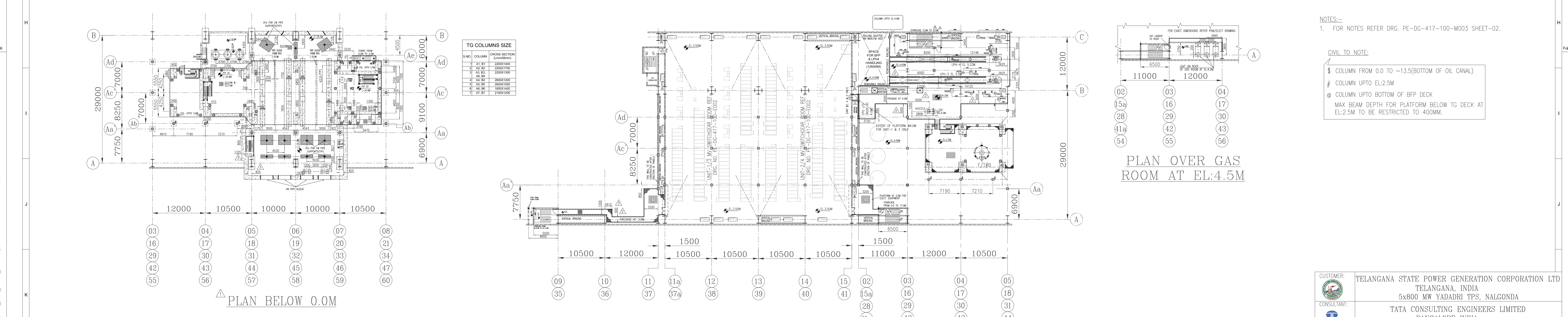
COPY RIGHT AND CONFIDENTIAL
The information on this drawing is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.

COMPUTER FILE NAME: ---

REV. 04		DATE 01.10.2020	ALTD DK	CHD MKG/SB	APPD SKB	REV. 01		DATE 13.12.19	ALTD MKG	CHD IP/SB-1	APPD SKB	REV. 02		DATE 19.02.2020	ALTD DK	CHD MKG/SB	APPD SKB
Revised as per TCE comments received vide transmittal no. TCE.11005A-ME-VDT-440 dated 03/SEP/2020						Revised as per TCE comments received vide transmittal ref no. TCE.11005A-ME-VDT-348 dated 17/10/2019						Revised as per TCE comments received vide transmittal no. TCE.11005A-ME-VDT-383 dated 20/FEB/2021.					
TITLE																	
EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (REGENERATION AREA)																	
DEPT. SCALE																	
SIGN																	
DRAWING NO. PE-DG-417-155-A003.3																	
SHEET 02 OF 02																	
REV. 04																	
SIZE-A0																	

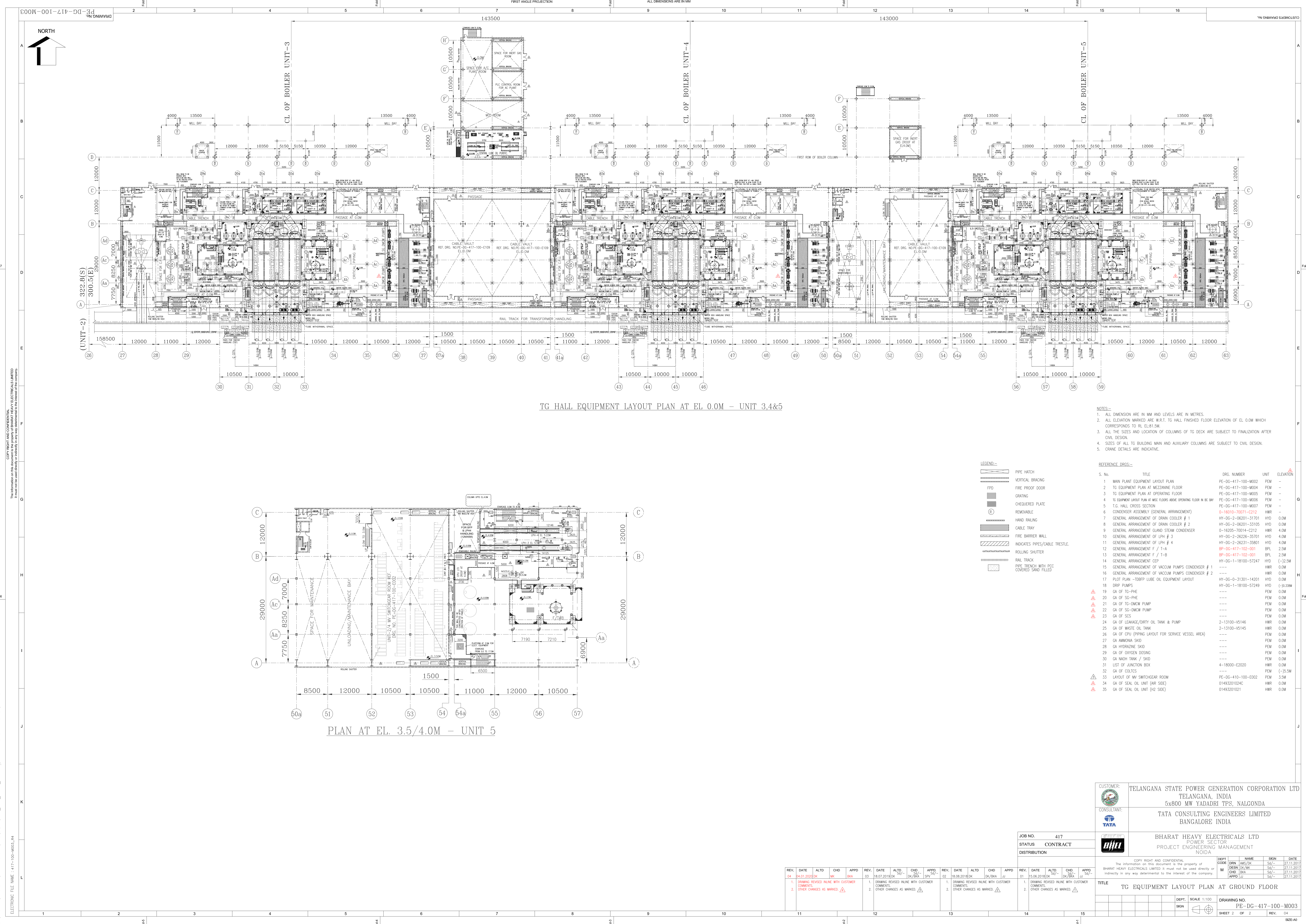


TG HALL EQUIPMENT LAYOUT PLAN AT EL 0.0M - UNIT 1&2



PLAN AT EL. 3.5/4.0M - UNIT 1,2 & 3,4

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD TELANGANA, INDIA 5X800 MW YADADRI TPS, NALGONDA		CONSULTANT: TATA CONSULTING ENGINEERS LIMITED BANGALORE INDIA	
JOB NO. 417 STATUS CONTRACT DISTRIBUTION		BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT Noida	
REV. DATE ALTD CHD APPD 04 06-01-2020 05 18-07-2019 06 09-09-2019 07 10-08-2019 08 10-08-2019 09 10-08-2019 10 10-08-2019 11 10-08-2019 12 10-08-2019 13 10-08-2019 14 10-08-2019 15 10-08-2019		REV. DATE ALTD CHD APPD 01 10-08-2019 02 10-08-2019 03 10-08-2019 04 10-08-2019 05 10-08-2019 06 10-08-2019 07 10-08-2019 08 10-08-2019 09 10-08-2019 10 10-08-2019 11 10-08-2019 12 10-08-2019 13 10-08-2019 14 10-08-2019 15 10-08-2019	
1. DRAWING REVISED IN LINE WITH CUSTOMER COMMENTS. 2. OTHER CHANGES AS MARKED.		1. DRAWING REVISED IN LINE WITH CUSTOMER COMMENTS. 2. OTHER CHANGES AS MARKED.	
TITLE TG EQUIPMENT LAYOUT PLAN AT GROUND FLOOR		DEPT. CODE NAME SIGN DATE M DESN NAME/DRK SS/- 27.11.2017 CHD LRA SS/- 27.11.2017 APPD SS/- 27.11.2017	
DEPT. SCALE 1:100 SIGN		DRAWING NO. PE-DG-417-100-M003 SHEET 1 OF 2 REV. 04	



TG HALL EQUIPMENT LAYOUT PLAN AT EL 0.0M - UNIT 3,4&5

- NOTES:-
1. ALL DIMENSION ARE IN MM AND LEVELS ARE IN METRES.
 2. ALL ELEVATION MARKED ARE W.R.T. TO HALL FINISHED FLOOR ELEVATION OF EL 0.0M WHICH CORRESPONDS TO RL EL+81.0M.
 3. ALL THE SIZES AND LOCATION OF COLUMNS OF TG DECK ARE SUBJECT TO FINALIZATION AFTER CIVIL DESIGN.
 4. SIZES OF ALL TO BUILDING MAIN AND AUXILIARY COLUMNS ARE SUBJECT TO CIVIL DESIGN.
 5. CRANE DETAILS ARE INDICATIVE.

LEGEND:-

- PIPE HATCH
- VERTICAL BRACING
- FIRE PROOF DOOR
- GRATING
- CHEQUERED PLATE
- REMOVABLE
- HAND RAILING
- CABLE TRAY
- FIRE BARRIER WALL
- INDICATES PIPES/CABLE TRESTLE
- ROLLING SHUTTER
- RAIL TRACK
- PIPE TRENCH WITH PCC COVERED SAND FILLED

REFERENCE DROS:-

S. No.	TITLE	DWG. NUMBER	UNIT	ELEVATION
1	MAIN PLANT EQUIPMENT LAYOUT PLAN	PE-DG-417-100-M002	PEM	-
2	TG EQUIPMENT PLAN AT MEZZANINE FLOOR	PE-DG-417-100-M004	PEM	-
3	TG EQUIPMENT PLAN AT OPERATING FLOOR	PE-DG-417-100-M005	PEM	-
4	TG EQUIPMENT LAYOUT PLAN AT MSC FLOORS ABOVE OPERATING FLOOR IN BC BAY	PE-DG-417-100-M006	PEM	-
5	T.G. HALL CROSS SECTION	PE-DG-417-100-M007	PEM	-
6	CONDENSER ASSEMBLY (GENERAL ARRANGEMENT)	0-16100-70071-C212	HWR	-
7	GENERAL ARRANGEMENT OF DRAIN COOLER # 1	HY-DG-2-06201-31701	HYD	0.0M
8	GENERAL ARRANGEMENT OF DRAIN COOLER # 2	HY-DG-2-06201-33105	HYD	0.0M
9	GENERAL ARRANGEMENT OF DRAIN COOLER # 3	0-16205-70014-C212	HWR	4.0M
10	GENERAL ARRANGEMENT OF LPH # 3	HY-DG-2-26226-35701	HYD	4.0M
11	GENERAL ARRANGEMENT OF LPH # 4	HY-DG-2-26231-35801	HYD	4.0M
12	GENERAL ARRANGEMENT OF LPH # 1	BP-DG-417-102-001	BPL	2.5M
13	GENERAL ARRANGEMENT OF LPH # 2	BP-DG-417-102-001	BPL	2.5M
14	GENERAL ARRANGEMENT OF LPH # 3	HY-DG-1-18100-57247	HYD	-12.5M
15	GENERAL ARRANGEMENT OF VACUUM PUMPS CONDENSER # 1	---	HWR	0.0M
16	GENERAL ARRANGEMENT OF VACUUM PUMPS CONDENSER # 2	---	HWR	0.0M
17	PLANT PLAN - TDRFP LUBE OIL EQUIPMENT LAYOUT	HY-DG-0-31301-14201	HYD	0.0M
18	DRIP PUMPS	HY-DG-1-18100-57249	HYD	-10.338M
19	GA OF TG-PHE	---	PEM	0.0M
20	GA OF SG-PHE	---	PEM	0.0M
21	GA OF TG-DMCW PUMP	---	PEM	0.0M
22	GA OF SG-DMCW PUMP	---	PEM	0.0M
23	GA OF SCS	---	PEM	0.0M
24	GA OF LEAKAGE/DIRTY OIL TANK & PUMP	2-13100-V5146	HWR	0.0M
25	GA OF WASTE OIL TANK	2-13100-V5145	HWR	0.0M
26	GA OF CRU (PIPING LAYOUT FOR SERVICE VESSEL AREA)	---	PEM	0.0M
27	GA AMMONIA SKID	---	PEM	0.0M
28	GA HYDRAZINE SKID	---	PEM	0.0M
29	GA OF OXYGEN DOSING	---	PEM	0.0M
30	GA NACH TANK / SKID	---	PEM	0.0M
31	LIST OF JUNCTION BOX	4-18000-E2020	HWR	0.0M
32	GA OF COLTCS	---	PEM	-15.5M
33	LAYOUT OF MW SWITCHGEAR ROOM	PE-DG-419-100-E002	PEM	3.5M
34	GA OF SEAL OIL UNIT (NR SIDE)	01493201024C	HWR	0.0M
35	GA OF SEAL OIL UNIT (H2 SIDE)	01493201021	HWR	0.0M

PLAN AT EL. 3.5/4.0M - UNIT 5

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD
04	04-01-2023	OK	WE	BRH	03	18-07-2018	OK	OK	BRH	02	18-08-2018	OK	OK	BRH
1. DRAWING REVISED INLINE WITH CUSTOMER COMMENTS.					1. DRAWING REVISED INLINE WITH CUSTOMER COMMENTS.					1. DRAWING REVISED INLINE WITH CUSTOMER COMMENTS.				
2. OTHER CHANGES AS MARKED.					2. OTHER CHANGES AS MARKED.					2. OTHER CHANGES AS MARKED.				

JOB NO.	417
STATUS	CONTRACT
DISTRIBUTION	

CUSTOMER:	TELANGANA STATE POWER GENERATION CORPORATION LTD TELANGANA, INDIA 5x800 MW YADADRI TPS, NALGONDA
CONSULTANT:	TATA CONSULTING ENGINEERS LIMITED BANGALORE INDIA
CLIENT:	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT Noida

TITLE	TG EQUIPMENT LAYOUT PLAN AT GROUND FLOOR
DEPT.	SCALE 1:100
SIGN	
DRAWING NO.	PE-DG-417-100-M003
SHEET 2	OF 2
REV.	04

279 of 665

373941/2021/PS-PEM-MAY

	FILE :		SPECIFICATION NO. PE-TS-417-155A-A001	
	5X800 MW YADADRI THERMAL POWER STATION		SECTION : I	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISING UNIT		SUB-SECTION: IB	
			REV. NO. 00	DATE :

SECTION – I
SPECIFIC TECHNICAL REQUIREMENTS
SUB-SECTION IB - Specific Technical Requirements (Electrical)

373941/2021/PS-PEM-MAX

	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 5X800 MW YADADRI TPS (ELECTRICAL PORTION)	SPECIFICATION NO. VOLUME NO. : II-B SECTION : I REV NO. : 00 DATE: 09/01/2020 SHEET : 4 OF 33
<u>SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL</u> 1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER: a) Services and equipment as per “Electrical Scope between BHEL and Vendor”. b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge. c) Supply of mandatory spares as specified in the specifications of mechanical equipment’s. d) Electrical load requirement for CONDENSATE PLOSHING UNIT. e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information. f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL. g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc. shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL. h) Motor shall meet minimum requirement of motor specification. i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL. j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “both end equipment in vendor’s scope” shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages. 2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS: Refer “Electrical Scope between BHEL and Vendor” Annexure - I. 3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate. 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc., is required during tender stage. Any such submission even if made, shall not be considered as part of offer.		

373941/2021/PS-PEM-MAX

	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 5X800 MW YADADRI TPS (ELECTRICAL PORTION)	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : I
		REV NO. : 00 DATE: 09/01/2020
		SHEET : 5 OF 33
4.0 List of enclosures : a) Electrical scope between BHEL & vendor (Annexure –I) b) Technical specification for motors. c) Datasheets for motors. d) Electrical Load data format (Annexure –II) e) BHEL cable listing format (Annexure –III) f) Quality plan for motors.		

373941/2021/PS-PEM-MAX

TITLE

LV MOTORS

DATA SHEET-A

SPECIFICATION NO.

VOLUME II B

SECTION I

REV NO. 00 DATE 09/01/2020

SHEET 18 OF 33

- | | | | |
|------|--|--|---|
| 1.0 | Design ambient temperature | : | 50 °C |
| 2.0 | Maximum acceptable kW rating of LV motor | : | ≤175KW |
| 3.0 | Installation (Indoors/ Outdoors) | : | As required |
| 4.0 | Degree Of Protection (Indoor/Outdoor) | : | IP55 |
| 5.0 | Type of Cooling | : | TEFC/CACA/TETV |
| 6.0 | Details of supply system | | |
| | a) | Rated voltage (with variation) | : 415V ± 10% |
| | b) | Rated frequency (with variation) | : 50 Hz (Variation: +3% TO –5%) |
| | c) | Combined voltage & freq. variation | : 10% |
| | d) | System fault level at rated voltage | : 50 kA for 1 sec |
| | e) | Short time rating for terminal boxes | |
| | | o 110kW & Above
(Breaker controlled) | : 50 kA for 0.25 sec |
| | | o Below 110kW (SFU+
Contactor controlled) | : 50 KA for 0.25 sec. |
| | f) | LV System grounding | : Solidly |
| 7.0 | Class of insulation | : | Class 'F', with temp rise limited to class B. |
| 8.0 | Minimum voltage for starting
(As percentage of rated voltage) | : | 80% of rated voltage |
| 9.0 | Power cables data | : | Shall be given during Detailed engg. |
| 10.0 | Earth Conductor Size & Material | : | Shall be given during Detailed engg. |
| 11.0 | Space heater supply | : | 240 V, 1Φ , 50 Hz |
| 12.0 | Rating up to which Single phase motor | : | Acceptable below 0.20 kW |
| 13.0 | Tests | : | As per Customer motor spec. (enclosed) |
| 14.0 | Energy efficient/ Flame proof motor | : | As per Customer spec. requirement |

- Also detail Customer spec. for Motors to be referred as enclosed with spec.

373941/2021/PS-PEM-MAX

TECHNICAL SPECIFICATION

BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)

	CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD TELANGANA, INDIA 5 x 800 MW YADADRI TPS, NALGONDA																																
	OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LTD BANGLORE INDIA																																
	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA																																
COPY RIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED it must not be used directly or indirectly in any way detrimental to the interest of the company.		<table border="1"> <thead> <tr> <th>DEPT</th> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>DRN</td> <td>HC</td> <td>s.d.</td> <td>07.12.17</td> </tr> <tr> <td>DESN</td> <td>HC</td> <td>s.d.</td> <td>07.12.17</td> </tr> <tr> <td>CHD</td> <td>AS</td> <td>s.d.</td> <td>07.12.17</td> </tr> <tr> <td>APPD</td> <td>PD</td> <td>s.d.</td> <td>07.12.17</td> </tr> </tbody> </table>	DEPT	NAME	SIGN	DATE	DRN	HC	s.d.	07.12.17	DESN	HC	s.d.	07.12.17	CHD	AS	s.d.	07.12.17	APPD	PD	s.d.	07.12.17											
DEPT	NAME	SIGN	DATE																														
DRN	HC	s.d.	07.12.17																														
DESN	HC	s.d.	07.12.17																														
CHD	AS	s.d.	07.12.17																														
APPD	PD	s.d.	07.12.17																														
TITLE BASIC TECHNICAL FEATURES FOR LT MOTORS																																	
<table border="1"> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>																						<table border="1"> <tr> <td>DEPT.</td> <td>SCALE</td> </tr> <tr> <td>SIGN</td> <td></td> </tr> </table>	DEPT.	SCALE	SIGN		<table border="1"> <tr> <td colspan="2">DRAWING NO.</td> </tr> <tr> <td colspan="2">PE-DC-417-565-E003</td> </tr> <tr> <td>SHEET</td> <td>REV. 02</td> </tr> </table>	DRAWING NO.		PE-DC-417-565-E003		SHEET	REV. 02
DEPT.	SCALE																																
SIGN																																	
DRAWING NO.																																	
PE-DC-417-565-E003																																	
SHEET	REV. 02																																

373941/2021/PS-PEM-MAX

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
		Rev. No.	02
		Dated	16-08-2018
		Page	12 of 33

1.0 This document covers the basic technical features of low tension (LT) squirrel cage induction AC motors employed for driving auxiliaries of BHEL-PEM scope packages in **5 x 800 MW YADRADRI TPS**.

2.0 CODES AND STANDARDS

All motors shall conform to the latest applicable standards as listed below;

- 1) Three phase induction motors: IS: 12615, IEC: 60034
- 2) Single phase AC motors: IS: 996, IEC: 60034
- 3) Crane duty motors: IS: 3177, IEC: 60034
- 4) Energy Efficient motors: IS 12615 or IEC: 60034-30 with Efficiency class IE3

3.0 DESIGN REQUIREMENTS

3.1 Service Conditions

The motors will be installed in hot, humid and tropical atmosphere highly polluted at places with coal dust and/or fly ash. For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

The design ambient temperature shall be 50 deg C.

3.2 Supply system and rated voltage of motors

KW rating	Supply system	Rated voltage of motor
Upto 0.2 kW	240V/415 V	240V/415 V
Above 0.2 kW & up to 175kW	415 V	415 V

3.2.1 Supply voltage & variations shall be as follows:-

Voltage variation (AC Supply): (+/-) 10%

Frequency variation : (+) 3% to (-) 5%

Combined V & F variation : 10% (sum of absolute values)

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

3.2.2 Motors shall be capable of running continuously at rated output for each of the conditions specified.

3.3 Motor Rating

All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity. LT motor rating at 50 degree C shall have at least 15% margin over the input power requirement of the driven equipment at rated duty point unless stated otherwise in driven equipment specification. The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.

3.4 Starting Requirements

3.4.1 Motor shall start smoothly and rapidly. Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The

373941/2021/PS-PEM-MAX

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
		Rev. No.	02
		Dated	16-08-2018
		Page	13 of 33

accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

- 3.4.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value of 85 (eighty five) percent rated voltage.

- 3.4.3 Continuous duty LT motors up to 175 KW Output rating (at 50 deg. C ambient temperature), shall be Premium efficiency (IE3) as per IEC: 60034-30/ IS: 12615 and the locked rotor current of motors shall as per IS 12615.

However, as per system requirement drives rated in the range of 160-210 KW may be considered in either 415V or 3.3 KV

- 3.4.4 Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction. The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage.

- 3.4.5 The following frequency of starts shall apply

- i) Three cold starts in succession with the motor being initially at a temperature not exceeding the ambient temperature.
- ii) Two hot starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- iii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature (not to be repeated in the second successive hour)

- 3.4.6 Locked motor withstand time of hot motors at 110% rated voltage shall be as follows:

- a) For motors with starting time upto 20 sec.
 - at least 3 sec. more than starting time.
- b) For motor with starting time above 20 secs but not exceeding 45 secs.
 - at least 5.0 sec. more than starting time.
- c) For motors with starting time above 45 secs.
 - at least 10%. more than starting time.

The starting time of the motor referred above is at minimum permissible voltage. Wherever the above requirements are not complied with, speed switches of approved make & type shall be provided to bypass the locked rotor protection for a pre-selected time during starting of motors. The speed switches shall have one NO & one NC contacts having maximum interrupting capacity of 5 Amps at 240V AC and 0.25 amps at 220 V DC.

Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.

373941/2021/PS-PEM-MAX

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
		Rev. No.	02
		Dated	16-08-2018
		Page	14 of 33

3.5 Running Requirements

- 3.5.1 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given above.
- 3.5.2 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.
- 3.5.3 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

3.6 Stress during bus Transfer

- 3.6.1 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.
- 3.6.2 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.

4.0 SPECIFIC REQUIREMENTS

4.1 Enclosure

All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy. For hazardous area approved type of increased safety enclosure shall be furnished.

4.2 Cooling

- 4.2.1 The motor shall be self-ventilated type, either totally enclosed fan cooled IC 411(TEFC), totally enclosed tube ventilated IC 511(TETV) or closed air circuit air- cooled IC 611(CACA).

4.3 Winding and Insulation

All insulated winding shall be of copper. All motors shall have class F insulation but limited to class B temperature rise. Windings shall be impregnated to make them non-hygroscopic and oil resistant.

Tropical Protection

All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

All fittings and hardware shall be corrosion resistant.

4.4 Bearings

- 4.4.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be rated for minimum service life of 40,000Hrs.
- 4.4.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

373941/2021/PS-PEM-MAX

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
		Rev. No.	02
		Dated	16-08-2018
		Page	15 of 33

- 4.4.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.
- 4.4.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.
- 4.4.5 Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication. LT motors 15kW and above shall be provided with external greasing arrangement.
- 4.4.6 Oiled bearing shall have an integral self-cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.
- 4.4.7 Forced lubricated or water cooled bearing shall be used as per requirement.
- 4.4.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.
- 4.4.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

4.5 Noise & Vibration

- 4.5.1 For 415V motors, maximum double amplitude vibrations upto 1500 rpm shall be 40 microns and 15 microns upto 3000 rpm.
- 4.5.2 The noise level shall not exceed 85db (A) at 1.5 meters from the motor.

4.6 Motor Terminal Box

- 4.6.1 Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation
- 4.6.2 Terminal box shall be capable of being turned 360 deg in steps of 90 Deg. for LT motors unless otherwise approved.
- 4.6.3 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.
- 4.6.4 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.
- 4.6.5 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.
- 4.6.6 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- 4.6.7 The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec.
- 4.6.8 Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.
- 4.6.9 The gland plate for single core cable shall be non-magnetic type. A suitable cable adopter box shall be provided if the cable size does not allow the direct termination in the main TB.