

ELECTRICAL SAFETY AUDIT REPORT

Audit conducted at

**Leading Food Industry
Ranjangaon, Pune**

Audit Period: 5th Dec 2016 to 20th Dec 2016

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Preamble:

This electrical safety audit at Leading Food Industry Ranjangaon setup was conducted to assess

- 1) Health of electrical infrastructure at plant.
- 2) Capacity utilization of existing electrical equipment.
- 3) Statutory compliance of various issues related to electrical safety.

Methodology:

- 1) Undertake survey of existing electrical infrastructure and understand SLD.
- 2) Undertake electrical load measurement using recording type power analyzers to know on load important electrical parameters like voltage, current, current harmonic distortion etc relevant to electrical safety.
- 3) Use above data to present load flow figures up to secondary level distribution
- 4) Use above data to validate cable sizes.
- 5) Measure earth resistance at each panel by loop earth testing method.
- 6) Measure earth pit resistance by fall of potential method by isolating earth pits wherever possible.
- 7) Undertake physical inspection of electrical panels, panel rooms, Panel clearances to check statutory compliance as per CEA 2010.

Executive summary of safety Audit report.

- 1) HT side electrical infrastructure at site appears to be reasonably well maintained. Following points require immediate attention.
 - a) Main incomer VCB PTs are out of order. UV/ OV protection will not work.
 - b) PC 36 transformer HT connection RHS side 1st phase as seen from front DO temperature high. Needs rectification of loose contact. (Currents are well within limit)
- 2) PC 21 transformer supports average 25% distorted current. If plant wishes, the same can be reduced by installing active harmonic filters at strategic locations as details in the report.
- 3) IR thermography reports related to few feeders connected to this transformer are submitted separately with this report. It is advised that the same should be attended on priority.
- 4) PC 36 transformer PCC harmonic current distortion appears to be 11%, however the same is more on some of the feeders.. If plant wishes, the same can be reduced by installing active harmonic filters at strategic locations as details in the report.
- 5) PC 36 transformer main breaker Y contact temperature is beyond 100Deg C – needs immediate attention.
- 6) IR thermography reports related to few feeders connected to this transformer are submitted separately with this report. It is advised that the same should be attended on priority.
- 7) Lightning arrestor arrangement was not located in the plant. A separate recommendation report is submitted to comply with IS 2905 and we recommend that the same should be implemented to limit liability under natural disaster.
- 8) All cable and switchgear capacities were assessed using recorded load flow data and were found to be adequate after considering RMS current and current harmonics. Presently switchgear settings are taking care of required co ordination to isolate the fault near to location, however List of recommended switchgear settings versus present settings will be submitted separately.
- 9) Loop earthing test results collected near each panel have shown satisfactory results.
- 10) Individual earth pits were tested with isolation, where ever possible and all earth resistane values / continuity with grid were found in order.

- 11) Panel clearances and other CEA 2010 provisions were checked for compliance. Detail report with photographs and minor procedural recommendations are included in report.
- 12) It is advised that the plant should designate appropriate person as electrical safety officer as per CEA 2010 provision and inform electrical inspector accordingly. Applicable provisions can be seen on recommended webpages in this report.
- 13) Diesel and LPG storage earthings were checked and found in order. If these premises are CCOE approved, the copies of necessary approved drawings should be stored along with MSEDCL approval documents.
- 14) Plant uses biogas based captive generation which is synchronised with PC 21 – PCC2. Plant has obtained all necessary permissions from inspectorate authorities and the approval documents were available at the time of audit.

Conclusion:

The electrical infrastructure at **Leading Food Industry** is at present in neat and tidy condition. The same is reasonably loaded and no signs of overloading or aging exist anywhere as of now. However the plant being a continuous process plant, we recommend periodic maintenance with shut down at regular interval.

An Arc – Flash study is also recommended for better understanding of flash hazards and necessary modifications as recommended by such study if carried out will reduce risks due to arc flash.

Reduction in current harmonics handled by cables and transformer will help in increasing life of these equipments and reduce heating.

Details of activities carried out.



1. Load flow study

We used recording type power analyzers to record power quality parameters to record all electrical parameters on primary and secondary distribution feeders during normal plant running. The analysis, and other relevant details are presented in this report. Simultaneously infrared thermography was also carried out on these feeders to locate abnormal temperatures and loose connections, which might lead to fire hazards or flash over. We have carried out harmonic analysis at PCC of both the transformers and the report is presented here.

2. Equipment adequacy

Load flow parameters gathered as above were used to ensure adequacy of cables, switchgears, transformers etc. Respective protection relays and their trip settings were verified against the requirements from this. Feeder wise list of these observations is enclosed in this report along with suggested actions for better safety.

3. Distribution panel and panel room layouts

Construction, electrical room layouts, clearances, required safety equipment available at site etc are verified against relevant standards , CEA rules and statutory requirements, we have enclosed related drawings prepared by us.

4. Plant protective earthing system

Earthing requirements for plant are calculated based on fault levels, soil resistivity and applicable standards. Survey and required measurements on actual installed earthing system are carried out to ensure compliance with above (Ref IS 3043, CEA 2010). The detailed report is enclosed. Wherever possible isolated earthpit resistance was also measured.

5. UPS and battery installations

Survey of UPS and battery rooms, UPS loading was undertaken to ensure safety. The UPS rooms were inspected against possible hydrogen leakage and associated safety majors. The report is included. BOQ

7. Lightning protection

Total plant area is about 60000 sq meters. Lightning protection requirements for the entire plant, buildings and open area under use was studied as per relevant IS standard and statutory requirements as per CEA rules. Adequacy of existing system was checked based on detail site survey (Ref IS 2309).

8. Earthing requirements for LPG storage

LPG / DIESEL storage earthing system was checked as per applicable standards. (Petroleum law 1934 as amended) The report will include BOQ with budget for improvements, if any inadequacies are found.

9. Physical Inspection

Site inspection, particularly for electrical distribution panels was carried out to locate possibilities of fire due to electrical reasons. The observations if any are included in this report.

10. Verification of required documentation

Various documents related to electrical infrastructure like single line diagrams, statutory permissions and test reports were verified and found to be in place. It is recommended that they all are kept together in hard copy original format with respective approval stamps accessible easily. The plant has large electrical distribution spread over huge area. Relevant documentation may be made available at each such section.

Description of Electrical infrastructure at Leading Food Industry Ranjangaon Plant.

- Plant receives 22 KV main supply as express feeder from Ranjangaon receiving station. Main incomer is protected with VCB in plant premises.
- Plant has two transformers of 2 MVA and HT distribution for these transformers is arranged through four pole structure and GODs.
- There are three DG sets of capacity 750KVA-380KVA & 1010 KVA
- The plant generates biogas and there is a biogas based electricity generation with installed capacity of 330KVA. This is synchronized with a downstream LT feeder which normally works on MSEDCL power. Plant has obtained a separate MSEDCL / electrical inspection wing government of Maharashtra sanction for this scheme.
- Plant has a running PPA with private power trader and receives power through this source as well. (It enters plant on same incoming 22KV MSEDCL supply)
- Plant Contract demand is around 2.5 MVA now split between MSEDCL and PPA source. It was informed to auditors that plant has decided to discontinue the PPA with immediate effect for commercial reasons.
- On LT side two main PCCs are installed namely PC-21 and PC-36
- On downstream there are about 19 PDBs and MCCs involving around 150 secondary distribution feeders. Most of these panels are located in LT room.
- Main process equipments are supported with large capacity ONLINE UPS systems.
PC-21-200KVA – Load 125KW
PC – 21 160 KVA – Load 75 KW
PC-36 Packaging-160KVA – Load 70KW
PC-36-Process -300KVA - Load 152KW
This indicates that out of 1700KW of total load, almost 425KW of process load works on UPS output which is almost 25%. This load directly does not experience any fluctuations on raw electric power.
- You have onsite LPG storage and your daily use is around 500Kg. You also use biogas generated on site.
- The plant earthing system is equipped with around 100 eartpits which are located at different strategic location and work in grid.
- **On inspection it was noticed that an effective lightning protection system does not exist at site.**

Audit Objective and the details of the equipment

Audit objective:

- 1) Physical assessment of electrical infrastructure at hospital, various load measurements using high end measuring equipment, capacity assessment of various electricity distribution equipment.
- 2) Inspection of electrical safety as per CEA 2010 provisions and as per best Industry practices.
- 3) Walk through energy audit of hospital infrastructure.

Details of Equipment Used:

No	Name of the equipment	SR. No Model	Make	Use
1	Power Analyzer	1645 (CA 8335)	Chauvin arnoux	Electrical Parameter Measurement
2	Power Analyzer	211642 (CA 8335)	Chauvin arnoux	Electrical Parameter Measurement
3	IR Imager	1910041-875-2	Testo	IR thermography
4	Loop Earth Tester		Motwani	Checking earth results

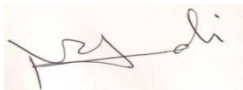
Audit team

MICROAIDS. Mr. Narendra Duvedi, (Electrical Engineer and Certified energy auditor)

Mr. Vijay Sonawne, Mr. Sandesh Birmane.

Certification:

Report Certified by:



Narendra R. Duvedi.

B.E. Electrical and Certified Energy Auditor Reg No: EA 10859

Chartered engineer

A note on Electrical safety

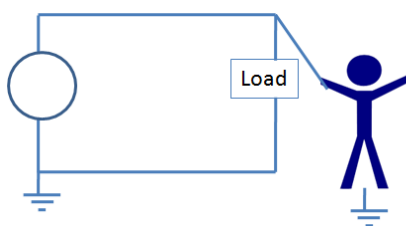
Electricity is most convenient secondary energy source which offers benefits like it is clean, easy to transport from one place to another etc. One can use it to generate heat, light or mechanical energy in the form of flow, pressure etc very efficiently.

The major drawback of electrical energy is – it cannot be seen or felt by human, whenever it is under normal use. Heat can be felt without touching; light can be seen without receiving any damage. Presence of electricity in a live conductor can be felt only after touching the same. The major effects are

- a) Severe damage to human being due to electrical shock which is mostly irreversible and can lead to death.
- b) Electrical sparking due to loose contacts and flashover can lead to fire.
- c) As a result of shock or fire or both there is always possibility of secondary damages to human like burns, deafness, blindness, falling from height etc.

What is electrical shock?

All human functions controlled by brain are actually result of electro chemical signals carried from brain to a particular limb by nerves in human body. So human heart pumps as per signals received from brain, we can move our hand whenever required due to an electrical signal received by a particular muscle. As shown in the picture, most of the external electrical sources have one terminal earthed or grounded and humans normally sit or stand on ground. Under normal condition the current passes through load. But if a person inadvertently or as a result of overconfidence or as an accident touches live part of the conductor before the load, he forms a parallel path to electrical current.



Human body in dry state offers a resistance of about 1600 ohms. So depending upon applied voltage and source capacity, current starts flowing through human body. Such current being much more compared to electrical signals sent by brain, various organs within human body get confused. Further such current produces heat inside the body which can burn the tissues. All such unwanted effects are termed as “Electric Shock”. The extent of damage to human body is governed by severity of shock i.e amount of current flowing through human body during the shock. 30 milliamps current if flows through human body for 5 seconds, then the shock can become fatal and can cause death. This indicates that even 50V are enough ($50/1500 = 31\text{ma}$) to get a fatal shock.

Electrical safety gets effected mainly due to:

- Wrong design
- Wrong selection of system parts
- Bad workmanship
- Poor maintenance
- Uneducated persons handling electrical work.
- Using electrical installations beyond it's life expectancy
- Over confidence in handling electrical equipment during operation / maintenance
- Using improper tools and tackles

At present electrical safety in India is governed by following notifications issued by Central electricity Authority – CEA – working under Central government energy ministry under electricity act 2003 as amended.

- a) CEA regulations “Measures relating to safety and electric supply” dated 20th Sept 2010
- b) CEA amendment regulations “Measures relating to safety and electric supply” dated 13th April 2015.

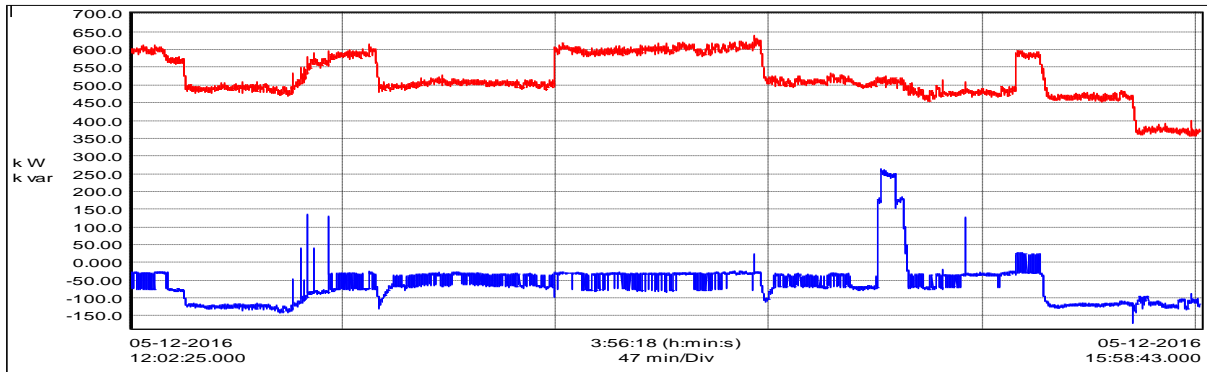
In a public place like factories, commercial buildings, bus stations, railway stations, airports, hotels, schools, colleges etc. the electrical safety becomes at most important as any negligence can affect common man. As per above notifications, organizations with connected load more than 250KW, are expected to designate a qualified person as electrical safety officer who would take responsibility of self certification regarding electrical safety. He is allowed to take help of third party experienced external auditors to identify problem areas and work on them to ensure safety.

----- END OF NOTE -----

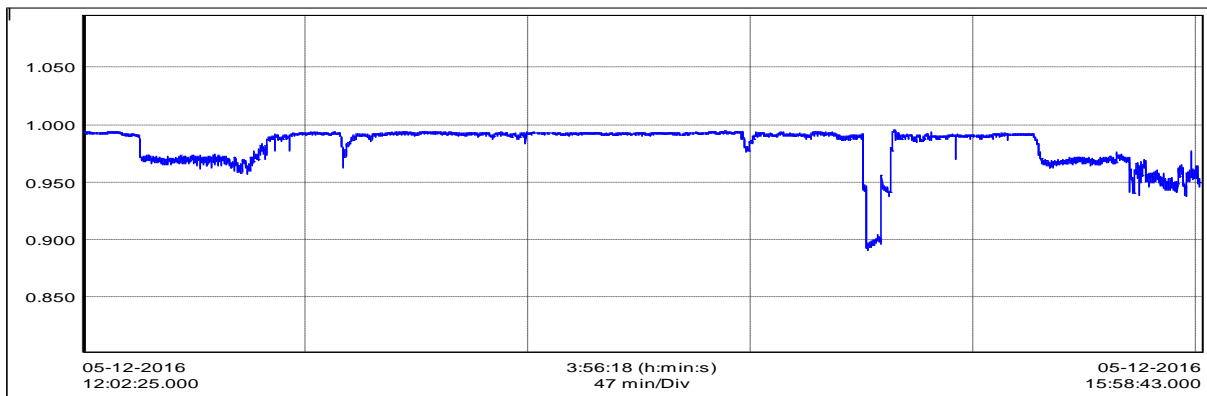
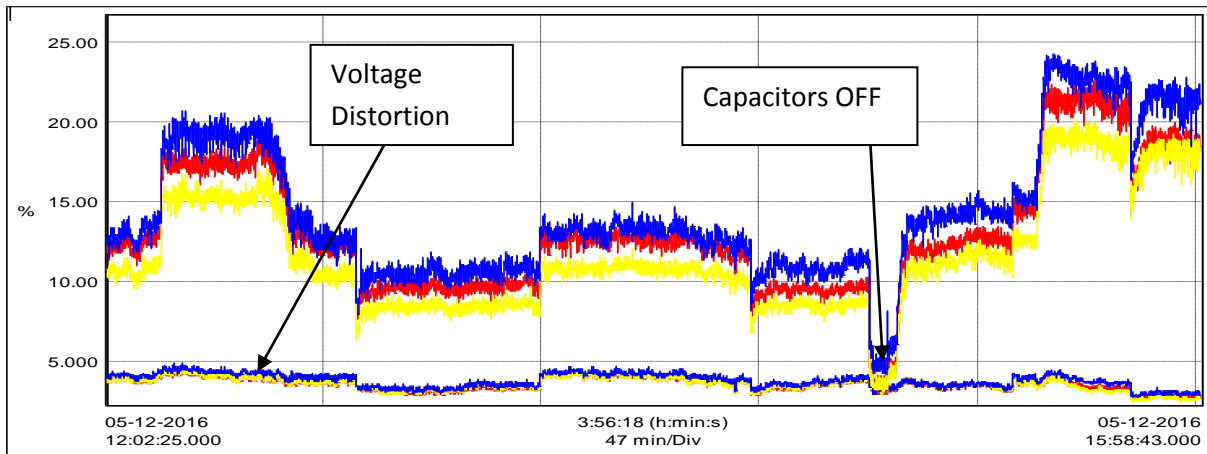
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Harmonic Analysis

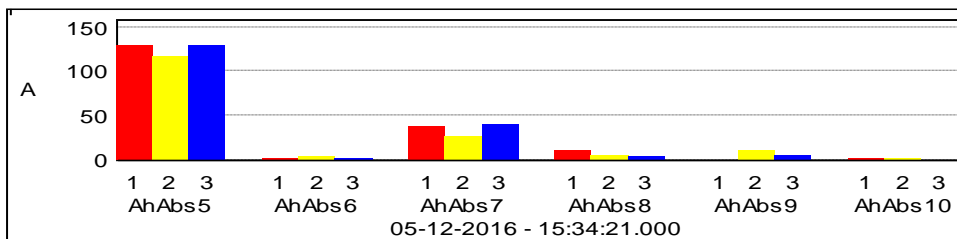
Tr 1 - PC 21. – 200KVAR fix capacitors



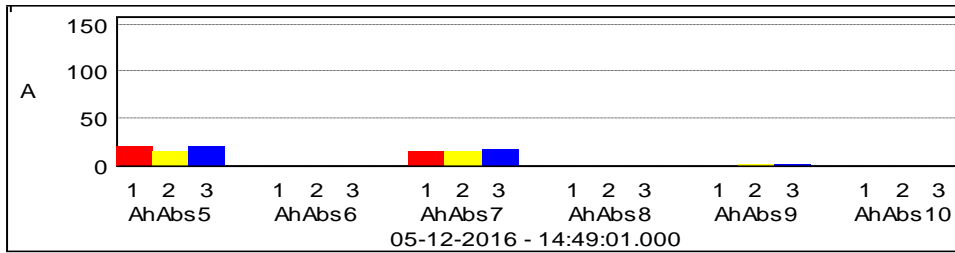
% Current and voltage harmonic distortion handled by transformer



Predominant 5th harmonic current under normal condition

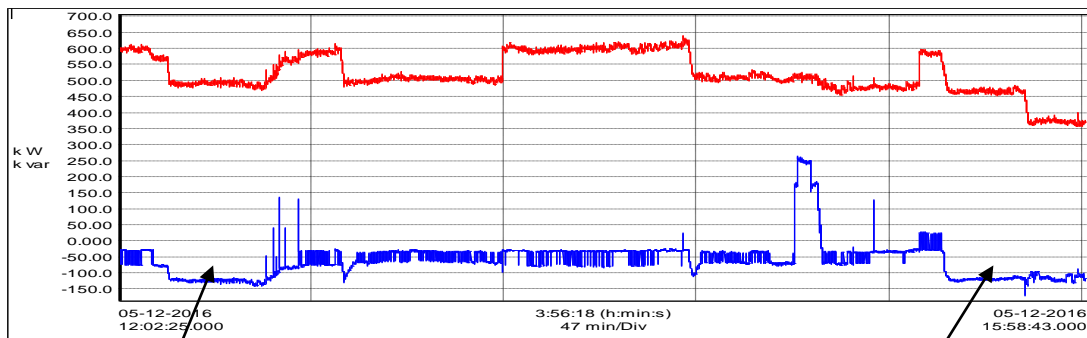


Reduction in 5th harmonic current when capacitors are OFF



Our observations:

- This transformer is loaded up to 40%. The apparent loading is more as the transformer is handling large amount of current harmonics.
- At present reactive power requirement of the load on this transformer remains continuously over compensated. 50 to 150KVAR are extra on continuing basis. This is happening as 200KVAR fixed correction is connected in this case.

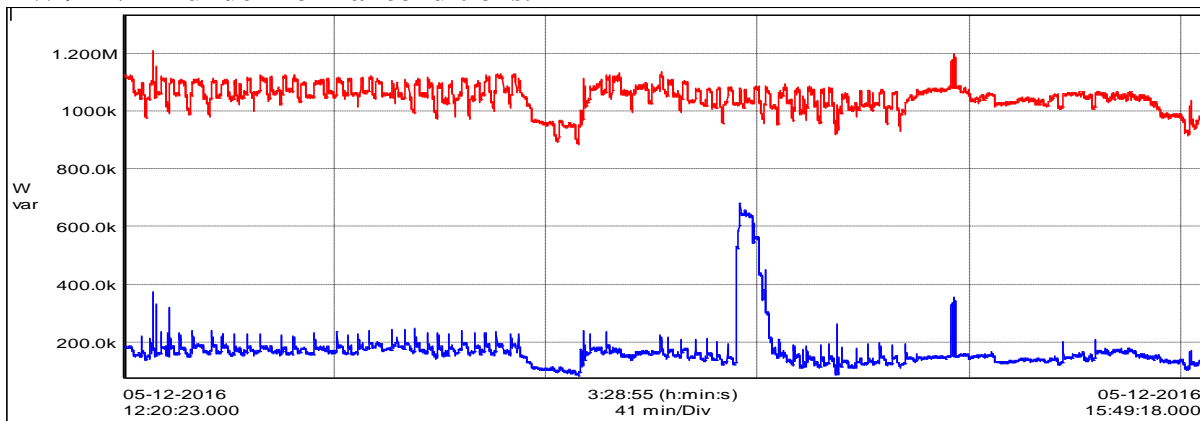


Over compensation happens when KW load is less due to fixed correction

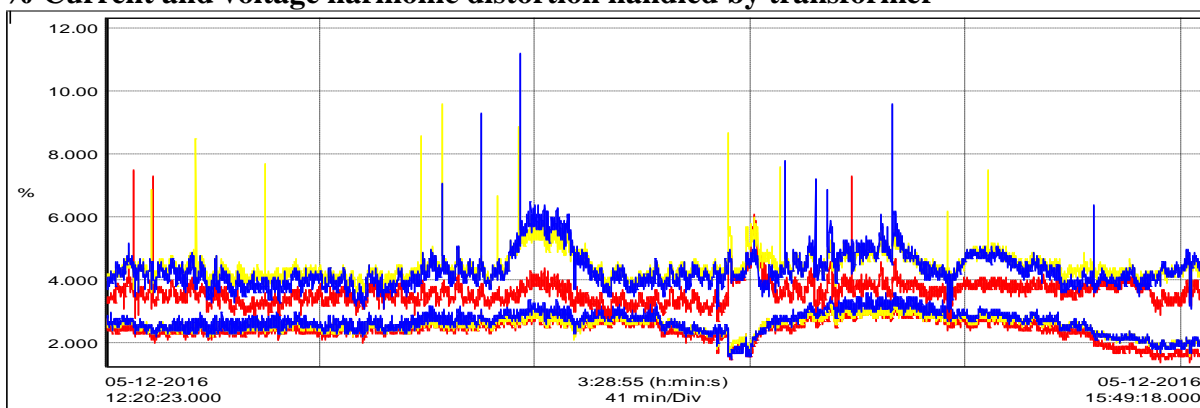
- This is the reason **we see harmonic resonance** here at 5th harmonic current and total current distortion is reaches even 25%. The 5th harmonic current reduces to 25Amps from 125Amps when capacitors are OFF. (This would have reduced further while recording, but we could not simulate that situation as it was not possible to switch off fixed capacitors on this transformer.
- It is recommended that in long run, you should use automatic “Thyristor switched” detuned filter panels for power factor correction as well as harmonic mitigation.
- Maintaining unity power factor along with controlled current harmonics, will reduce transformer loss, associated temperature rise and will contribute in increasing transformer life.

Tr2 – PC 36 – 100KVAR fixed

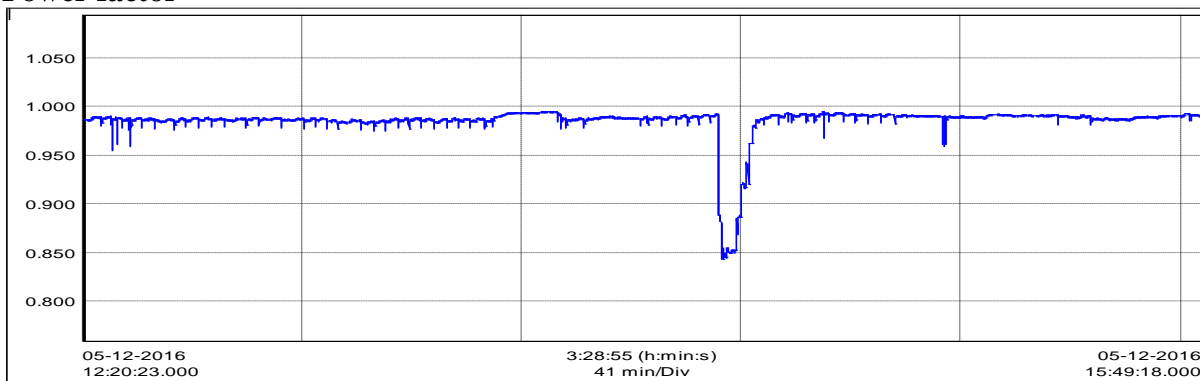
KW / KVAR under normal conditions.



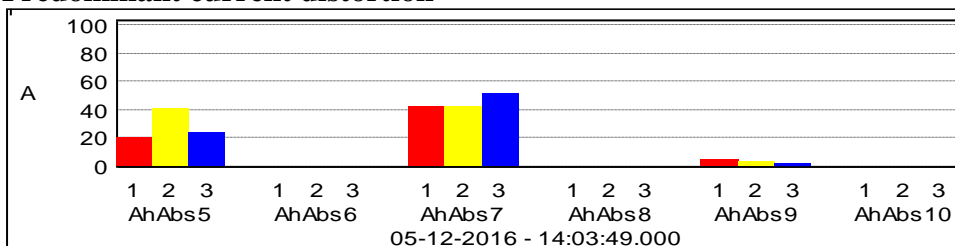
% Current and voltage harmonic distortion handled by transformer



Power factor



Predominant current distortion



Our observations:

- This transformer is loaded up to 75%
- Considering contribution and possibility of non linear load inclusion, we recommend that you should not load this transformer beyond present loading.
- At present reactive power requirement of the load on this transformer is not fully compensated. There is a requirement of 200KVAR on continuing basis.
- This is the reason **we do not see harmonic resonance** here and total current distortion is less than 6%.
- It is recommended that in long run, you should use automatic “Thyristor switched” detuned filter panels for power factor correction as well as harmonic mitigation.
- Maintaining unity power factor along with controlled current harmonics, will reduce transformer loss, associated temperature rise and will contribute in increasing transformer life.

LOAD FLOW ANALYSIS.

CABLE VALIDATION

INTERNAL EARTHING RESULTS.

Transformer -1 – 2MVA (PC-21) LT Panel

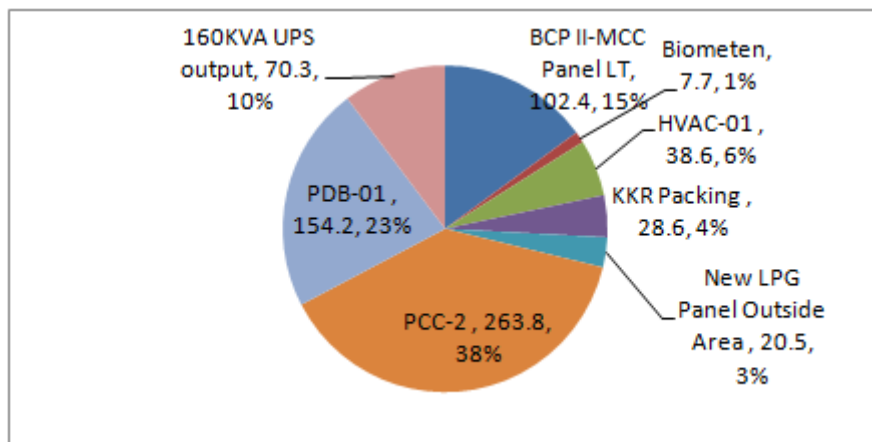
Power Quality table

Tr-1 (PC-21)																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	Main incomer Tr-1 (PC-21)	242.4	251.9	420.5	436.8	3.8	4.9	749.2	921.8	14.4	24.3	520.0	642.3	-58.2	-169.8	0.98	0.89
2	BCP II-MCC Panel LT	243.1	244.8	421	424	3.8	4.3	123.4	323.7	20.5	41.7	95.7	102.4	38.8	86.7	0.92	0.93
3	Biometen	239.4	240.8	414.8	417.3	4.7	5.1	14.9	19.3	10.8	11.9	6.6	7.7	7.8	8.4	0.64	0.68
4	HVAC-01	241.3	243.1	418.3	421.6	4.1	4.9	75.5	78.6	9.2	10.8	37	38.6	37.7	39.3	0.7	0.71
5	KKR Packing	240.7	242.6	417	420.4	4.4	5.1	36.1	44.2	17.1	29.1	22.5	28.6	9	10.4	0.92	0.95
6	New LPG Panel Outside Area	242.2	244.2	419.6	423	4	4.6	23.4	38.2	4	116.9	16.6	20.5	3.5	6.5	0.97	0.99
7	PCC-2	241.3	244.2	418	423.1	4.1	4.7	371.8	473.1	11.1	34.8	240.2	263.8	115.4	217.7	0.9	0.92
8	PDB-01	240.9	242.8	417.4	420.7	4.3	4.8	256.3	276	34.6	35.9	141.4	154.2	107.2	114.9	0.8	0.81
9	Utility-01 Old-LT	239.4	240.6	414.9	416.9	4.7	5.1	145.1	162.5	10.7	13.4	87.5	96.1	48.8	58.7	0.87	0.88

This transformer caters to around 650KW max load and supports around 24% current harmonic distortion.

Allowing 25% derating to accommodate these harmonics, this transformer can be assumed to be loaded up to 800KW.

Installation of 150A active harmonic filter at LT PCC of this transformer will reduce current harmonics handled by this transformer and associated loss.



PDB 01, PCC 2 in above put together the load is 61% and the current harmonic distortion is around 35%. The active harmonic filters suggested above may be connected to incomers of these two panels. This will reduce losses in these cables and also prevent extra heating.

Cable Size validation

Tr-1 (PC-21)								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	Main incomer Tr-1 (PC-21)	749.2	921.8	14.4	24.3			
2	BCP II-MCC Panel LT	123.4	323.7	20.5	41.7	185sqmm/3.5/AL/2	480	adequate
3	Biometen	14.9	19.3	10.8	11.9	300sqmm/3.5/AL/1	315	adequate
4	HVAC-01	75.5	78.6	9.2	10.8	240sqmm/3.5/AL/3	840	adequate
5	KKR Packing	36.1	44.2	17.1	29.1	300sqmm/3.5/AL/1	315	adequate
6	New LPG Panel Outside Area	23.4	38.2	4	116.9	300sqmm/3.5/AL/2	630	adequate
7	PCC-2	371.8	473.1	11.1	34.8	300sqmm/3.5/AL/2	630	adequate
8	PDB-01	256.3	276	34.6	35.9	240sqmm/3.5/AL/3	840	adequate
9	Utility-01 Old-LT	145.1	162.5	10.7	13.4	300sqmm/3.5/AL/2	630	adequate

As per above chart the cables connected to this panel and reaching respective subpanels appear to be adequate in capacity.

Earthing

PANEL	RESISTANCE (Ω)	Remark
Main LT Panel PC-21	0.023	Ok
	0.86	Ok

Infrared Thermography

On Load Thermography investigation of this panel does not reveal any abnormality.

Power Quality table for sub feeders.

BCP II-MCC Panel LT																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	Main incomer BCP-2	244.1	246.4	3.8	4.9	423.3	427.1	152.7	163.3	29.2	33	98.1	104.3	39.9	45	0.93	0.93
2	Oven	231.2	231.4	400	400.5	1.3	1.6	5.4	5.4	68.2	70.9	2.9	2.9	2.2	2.2	0.8	0.8
3	BCP Blender	244.8	245.6	424.4	425.6	3.7	3.9	26.8	27.5	8.7	9.3	11.1	11.8	15.8	16.1	0.57	0.6
4	Extruder Panel	244.1	245.6	423.2	425.7	3.5	3.9	119.2	122.3	34.6	35.8	79.3	81.3	32.3	33.3	0.93	0.93
Extruder Panel																	
1	160KVA UPS Input	244.4	245.7	424.2	426.2	3.4	3.7	112.2	114.8	37.2	38.9	74.1	75.8	31.2	31.8	0.92	0.92
2	160KVA UPS output	231.6	231.8	401.1	401.4	1.2	1.4	106.8	109.4	30.6	31.7	68.8	70.3	25.9	26.4	0.94	0.94

Cable validation

BCP II-MCC Panel LT								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	Main incomer BCP-2	152.7	163.3	29.2	33	185sqmm/3.5/AL/2	480	adequate
2	Oven	5.4	5.4	68.2	70.9	10sqmm/4/CU/1	50	adequate
3	BCP Blender	26.8	27.5	8.7	9.3	10sqmm/4/CU/1	50	adequate
4	Extruder Panel	119.2	122.3	34.6	35.8	120sqmm/4/CU/1	225	adequate

Earthing

PANEL	RESISTANCE (Ω)	Remark
BCP II MCC Panel (PC-21)	0.017	Ok

Infrared Thermography

On Load Thermography investigation of this panel revealed following abnormality.

- Extruder panel 160KVA UPS input feeder – cable Y phase nut bolt is loose. For details IR Thermography report.

Main Incomer HVAC 1 Panel - Power Quality table

HVAC-01																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	Main incomer HVAC 1 Panel	238.1	240.1	412.7	416.1	3.7	3.9	75.3	77.9	13.2	14.8	36.4	38.1	35.9	37.2	0.71	0.72
2	AHU -01 Trim & Pair	240.5	240.9	416.9	417.6	3.6	3.7	3.5	3.5	6.6	7	1.6	1.6	1.9	1.9	0.65	0.65
3	chromosort chiller	241.5	242	418.6	419.4	4.2	4.3	1.5	1.5	6.9	7.1	0.443	0.445	0.928	0.936	0.43	0.43
4	Lab AHU (VFD -50 HZ)	239.4	239.8	415.1	415.7	3.5	3.7	2.2	2.3	212.7	224.3	0.625	0.631	-1.3	-1.3	0.43	0.42
5	Office AHU (VFD-45 HZ)	240.9	241.2	417.8	418.4	3.3	3.6	4.6	4.9	206.6	223.6	1.3	1.3	-2.5	-2.8	0.45	0.42
6	PC-21 Dust collector	238.4	239.1	413.4	414.7	3.6	3.7	6	6.1	11.3	11.7	3	3.1	2.8	2.8	0.73	0.74
7	RE -7 Guznake Conveyer	241.2	241.8	418	419.2	4.1	4.6	2.6	2.6	8.7	9.7	1.2	1.2	1.5	1.5	0.62	0.63
8	RE-2 Slicker	241.5	242	418.6	419.6	3.3	4.2	3.1	3.1	8.6	10.2	0.671	0.674	2	2	0.31	0.31
9	RE-4 FRYER	241.1	241.7	417.9	419	4	4.2	2.3	2.3	8.4	8.8	1.1	1.1	1.2	1.2	0.68	0.68
10	Ventilation (60 HP)	242.7	244	420.6	422.9	4.2	4.6	51	51.8	7.1	8.1	26	26.3	25.6	26.1	0.71	0.72

Cable validation

HVAC-01								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	Main incomer HVAC 1 Panel	75.3	77.9	13.2	14.8	240sqmm/3.5/AL/3	840	adequate
2	AHU -01 Trim & Pair	3.5	3.5	6.6	7	4sqmm/3/CU/1	28	adequate
3	chromosort chiller	1.5	1.5	6.9	7.1	2.5sqmm/3/CU/1	22	adequate
4	Lab AHU (VFD -50 HZ)	2.2	2.3	212.7	224.3	2.5sqmm/3/CU/1	22	adequate
5	Office AHU (VFD-45 HZ)	4.6	4.9	206.6	223.6	4sqmm/3/CU/1	28	adequate
6	PC-21 Dust collector	6	6.1	11.3	11.7	6sqmm/3/CU/1	37	adequate
7	RE -7 Guznake Conveyer	2.6	2.6	8.7	9.7	4sqmm/3/CU/1	28	adequate
8	RE-2 Slicker	3.1	3.1	8.6	10.2	4sqmm/3/CU/1	28	adequate
9	RE-4 FRYER	2.3	2.3	8.4	8.8	4sqmm/3/CU/1	28	adequate
10	Ventilation (60 HP)	51	51.8	7.1	8.1	16sqmm/3/AL/2	102	adequate

Earthing

PANEL	RESISTANCE (Ω)	Remark
HVAC I Panel (PC-21)	0.75	Ok

Infrared Thermography

On Load Thermography investigation of this panel did not reveal any abnormality.

Power Quality table – PCC 21 - PCC – 02 and it's sub feeders

PCC-02																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
	Biogas Generator	242.9	244.4	420.5	423.1	3.2	3.6	144.6	149.1	30.2	34.7	88.8	89.4	22.8	29.9	0.95	0.96
1	Main incomer to PCC-2 Panel	244.4	246.7	423	426.9	3.9	4.4	350.7	479.9	9.7	10.8	229.9	265.2	113.7	226.1	0.9	0.93
2	HVAC-II	244.1	245.4	422.6	424.7	3.9	4.4	86.8	93.9	18.9	21.1	39.4	42.7	44.8	48.7	0.66	0.67
3	KKR Line (Incoming from PCC2 main incomer)	243.6	245.3	421.6	424.4	4.2	4.7	97.6	224.5	9.7	18.9	52.5	124.3	39.7	95.2	0.75	0.85
4	Lighting MLDb-1 (100KVA Stabilizer)	244.7	246.1	423.5	426.1	4.3	4.8	70.8	78.1	21.2	24.5	50.2	54.3	11.2	13.3	0.97	0.98
5	Lighting MLDB-2	244.7	246.3	423.5	426.4	4.4	4.9	20.8	21	19.2	20.6	4.8	4.9	-1.5	-1.6	0.95	0.95
6	UPS KKR	242.8	244.2	420.5	422.8	4.1	4.4	40.9	42.2	12.4	16.2	17.8	18.1	-21.5	-21.8	0.64	0.62
HVAC-II																	
1	Main Incomer	239.4	240.3	414.6	416.2	2.7	3	87.8	88.8	20.6	22.1	38.4	38.6	39.2	40	0.7	0.7
2	AHU-10 Mixing	239.8	240.2	415.1	415.9	2.6	2.8	1.5	1.5	4.8	5.2	0.424	0.426	0.932	0.936	0.41	0.42
3	AHU-12	239.4	240.3	414.6	416.2	2.7	2.9	4	4.1	7.3	8	1.4	1.4	2.4	2.5	0.49	0.5
4	KKR Packaging AHU No – 8	240.8	241.5	416.2	417.5	2.7	3	12.3	12.7	166.3	184.6	4.2	4.2	-6.8	-7.3	0.52	0.5
5	KKR RE - 4	240	240.8	415.6	416.9	2.5	2.8	3.4	3.4	7.2	8	1.4	1.4	1.9	1.9	0.59	0.6
6	KKR RE-1	241.3	242.2	418	419.6	2.4	2.6	5.7	5.8	5.3	6.1	1.6	1.6	3.7	3.8	0.38	0.39
7	KKR RE-2	243.6	244.1	422	422.6	2.4	2.5	3.8	3.9	5.8	6.4	1.3	1.3	2.4	2.4	0.49	0.49
8	KKR RE-4	242.7	243.8	420.4	422.2	2.5	2.7	5.7	5.8	5.5	6	2.8	2.9	2.9	3	0.7	0.7
9	KKR RE-5	241.4	241.9	418.2	418.9	2.5	2.7	3.8	3.9	7.5	8	1.4	1.4	2.2	2.3	0.54	0.55
10	TWZ PKG AHU-9	240.4	241.2	416.2	417.5	2.4	2.7	7.2	7.3	9.9	11.3	2.6	2.7	4	4	0.55	0.56
11	TWZ RE-2	242.1	242.7	419.4	420.3	2.5	2.7	3.6	3.7	6.8	7.5	1	1	-2.3	-2.3	0.4	0.39
12	TWZ RE-4	241.1	241.8	417.7	418.8	2.5	2.6	3.9	3.9	5.6	6.2	1.7	1.7	2.1	2.2	0.62	0.62
13	TWZ RE-5	239.8	240.5	415.3	416.4	2.6	2.9	4.1	4.1	5.9	6.7	2	2	2	2	0.71	0.71
14	TWZ Ventilation (BCP)	238.3	239.3	412.7	414.6	2.6	2.9	37.1	37.3	16.9	18	15.5	15.5	11.6	11.8	0.77	0.77
KKR Line (Incoming from PCC2)																	
1	Main incomer KKR LINE Main Incomer	245.8	247.7	425	428.6	3.6	4.1	173	226.4	15.9	18.3	99.3	126.3	78.1	103.6	0.79	0.86
2	Extruder No. 1	247.3	248.4	427.7	429.5	3	3.4	39.2	39.8	19.9	21.2	19.7	20	20.5	20.8	0.69	0.7
3	Extruder no.02	245.9	247.2	425.2	427.7	3.8	4.1	38.1	38.6	20	21	20.9	21.2	17.8	18.1	0.76	0.76
4	Extruder no.03	245.6	246.1	424.6	425.6	3.8	4.1	41	41.3	19.7	20.5	22.3	22.5	17.9	18.1	0.78	0.78
5	Extruder no.05	245.5	246.1	424.4	425.5	3.7	4.1	31.5	31.9	46.5	48.3	20.1	20.3	10.2	10.3	0.89	0.89
Lighting MLDB-1 (100KVA Stabilizer)																	
1	Main Incomer	222.2	223.4	384.9	387.3	2.5	3.2	31.7	45.8	10.5	25.2	19.3	22.1	-2	-3.5	0.98	0.97
2	LDB-2	222.6	223.2	385.5	386.6	3.1	3.4	21.7	21.8	11.5	11.9	8.3	8.3	-0.099	-0.109	0.99	0.99
3	LDB-3	221.8	222.3	384	385	3	3.2	14.6	14.6	20.3	21	7.1	7.1	-1.9	-1.9	0.97	0.97
4	LDB-4	221	221.4	382.7	383.3	3.1	3.3	6.7	19.6	15.7	48.5	2.2	4.8	0.558	2.4	0.96	0.98
5	LDB-10	220.7	221.1	382.1	382.9	3.2	3.4	7.7	7.7	16.3	17.3	2.1	2.1	1.8	1.9	0.66	0.66
6	LDB-12	220.8	221.2	382.4	383.1	2.9	3.1	1.1	1.1	43.5	43.6	0.073	0.075	0.229	0.23	0.3	0.31
Lighting MLDB-2 (100KVA Stabilizer)																	
1	Main Incomer	226.8	227.9	393.4	395.1	2.5	2.8	21.2	21.3	14.5	15.8	12	12.1	-2.88	-2.7	0.92	0.92
2	LDB-1	221.8	222.1	384.6	385	2.8	2.9	4.3	4.3	8.8	9	2	2.1	-0.895	-0.914	0.91	0.91
3	LDB-2	222	222.4	384.8	385.5	2.9	2.9	3.9	3.9	10.9	11.2	2.3	2.3	0.255	0.257	0.94	0.94
4	LDB-7	221.1	221.6	383	383.9	2.9	3.1	2.5	2.5	16.1	16.3	0.545	0.545	-0.313	-0.314	0.91	0.91
5	LDB-8	220.2	220.8	381.3	382.6	3	3.2	1.1	1.1	16.8	17.2	0.37	0.372	0.248	0.25	0.8	0.8
6	LDB-9	220.7	221	382.4	382.9	2.9	3	2.5	2.5	37	37.7	0.444	0.447	-0.322	-0.324	0.81	0.81
7	LDB-16	221.6	222	383.9	384.5	3	3.1	2.3	2.3	9.3	9.4	0.586	0.587	0.166	0.168	0.67	0.67
8	MLDB Change room	222	222.2	384.8	385.3	3	3.2	2.2	2.2	48.8	49.1	0.479	0.482	-0.221	-0.223	0.89	0.89
9	Parking	221.1	221.2	383.1	383.3	3	3.3	10.4	10.4	22.9	23.6	1.2	1.2	-2	-2	0.51	0.51
10	PC 21 Process line	220.8	221.2	382.4	382.9	3	3.3	7	7	13.2	13.8	3	3	0.379	0.385	0.95	0.95
Lighting MLDB-2																	
1	Main Incomer	242.1	243.2	419.3	421.2	2.9	3.2	19.8	20	15.1	16.5	7	7	-2.6	-2.7	0.92	0.92
2	LDB-21	242.2	243	419.4	421	2.8	3	1.7	1.7	9	9.3	0.982	0.983	-0.149	-0.151	0.99	0.99
3	LDB-22	241.7	242.3	418.5	419.4	2.9	3	4.7	4.8	6.1	6.3	1.13	1.13	-0.164	-0.164	0.99	0.99
4	LDB-23	241.8	242.6	418.7	420.1	2.8	2.9	0.93	0.93	11.1	12.6	0.509	0.51	-0.098	-0.1	0.98	0.98
5	LDB-24	242.6	243	420.1	420.8	2.7	2.8	3.1	3.1	15.1	15.8	0.747	0.748	-0.673	-0.676	0.66	0.66
6	New Store LDB -PDB	242.4	243.2	419.4	420.8	2.6	2.7	6.1	6.2	34.9	35.9	2.4	2.4	-1.1	-1.1	0.9	0.9
7	PDB-22	242.6	243	420.1	420.8	2.8	2.9	3.5	3.5	7.6	7.9	2	2	0.356	0.354	0.96	0.96
8	PDB-23	242.4	242.8	419.9	420.9	2.9	3.2	2.3	2.4	5.2	6.2	1.2	1.3	1.1	1.1	0.74	0.76

Cable validation

PCC-02								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	Main incomer to PCC-2 Panel	350.7	479.9	9.7	10.8	300sqmm/3.5/AL/2	630	adequate
2	HVAC-II	86.8	93.9	18.9	21.1	185sqmm/3.5/AL/2	480	adequate
3	KKR Line	97.6	224.5	9.7	18.9	185sqmm/3.5/AL/2	480	adequate
4	Lighting MLDB-1 (100KVA Stabilizer)	70.8	78.1	21.2	24.5	185sqmm/3.5/AL/2	480	adequate
5	Lighting MLDB-2	20.8	21	19.2	20.6	185sqmm/3.5/AL/1	240	adequate
6	UPS KKR	40.9	42.2	12.4	16.2	240sqmm/3.5/AL/1	280	adequate
HVAC-II								
1	Main Incomer	87.8	88.8	20.6	22.1	185sqmm/3.5/AL/2	480	adequate
2	AHU-10 Mixing	1.5	1.5	4.8	5.2	2.5sqmm/3/AL/1	18	adequate
3	AHU-12	4	4.1	7.3	8	2.5sqmm/3/AL/1	18	adequate
4	KKR Packaging AHU No - 8	12.3	12.7	166.3	184.6	2.5sqmm/3/AL/1	18	adequate
5	KKR RE - 4	3.4	3.4	7.2	8	2.5sqmm/3/AL/1	18	adequate
6	KKR RE-1	5.7	5.8	5.3	6.1	2.5sqmm/3/AL/1	18	adequate
7	KKR RE-2	3.8	3.9	5.8	6.4	2.5sqmm/3/AL/1	18	adequate
8	KKR RE-4	5.7	5.8	5.5	6	2.5sqmm/3/AL/1	18	adequate
9	KKR RE-5	3.8	3.9	7.5	8	2.5sqmm/3/AL/1	18	adequate
10	TWZ PKG AHU-9	7.2	7.3	9.9	11.3	2.5sqmm/3/AL/2	18	adequate
11	TWZ RE-2	3.6	3.7	6.8	7.5	2.5sqmm/3/AL/1	18	adequate
12	TWZ RE-4	3.9	3.9	5.6	6.2	2.5sqmm/3/AL/1	18	adequate
13	TWZ RE-5	4.1	4.1	5.9	6.7	2.5sqmm/3/AL/1	18	adequate
14	TWZ Ventilation (BCP)	37.1	37.3	16.9	18	16sqmm/3/AL/2	102	adequate
KKR Line (Incoming from PCC2)								
1	Main incomer	173	226.4	15.9	18.3	185sqmm/3.5/AL/2	480	adequate
2	Extruder No. 1	39.2	39.8	19.9	21.2	185sqmm/3.5/AL/1	240	adequate
3	Extruder no.02	38.1	38.6	20	21	95sqmm/3.5/AL/1	155	adequate
4	Extruder no.03	41	41.3	19.7	20.5	95sqmm/3.5/AL/1	155	adequate
5	Extruder no.05	31.5	31.9	46.5	48.3	95sqmm/3.5/AL/1	155	adequate
Lighting MLDB-1 (100KVA Stabilizer)								
1	Main Incomer	31.7	45.8	10.5	25.2	185sqmm/3.5/AL/1	240	adequate
2	LDB-2	21.7	21.8	11.5	11.9	95sqmm/3.5/AL/1	155	adequate
3	LDB-3	14.6	14.6	20.3	21	95sqmm/3.5/AL/1	155	adequate
4	LDB-4	6.7	19.6	15.7	48.5	10sqmm/4/AL/1	40	adequate
5	LDB-10	7.7	7.7	16.3	17.3	10sqmm/4/AL/1	40	adequate
6	LDB-12	1.1	1.1	43.5	43.6	16sqmm/4/AL/1	51	adequate
Lighting MLDB-2 (100KVA Stabilizer)								
1	Main Incomer	21.2	21.3	14.5	15.8	185sqmm/3.5/AL/1	240	adequate
2	LDB-1	4.3	4.3	8.8	9	16sqmm/4/AL/1	51	adequate
3	LDB-2	3.9	3.9	10.9	11.2	16sqmm/4/AL/1	51	adequate
4	LDB-7	2.5	2.5	16.1	16.3	16sqmm/4/AL/1	51	adequate
5	LDB-8	1.1	1.1	16.8	17.2	16sqmm/4/AL/1	51	adequate
6	LDB-9	2.5	2.5	37	37.7	16sqmm/4/AL/1	51	adequate
7	LDB-16	2.3	2.3	9.3	9.4	16sqmm/4/AL/1	51	adequate
8	MLDB Change room	2.2	2.2	48.8	49.1	16sqmm/4/AL/1	51	adequate
9	Parking	10.4	10.4	22.9	23.6	16sqmm/4/AL/1	51	adequate
10	PC 21 Process line	7	7	13.2	13.8	6sqmm/4/AL/1	30	adequate
Lighting MLDB-2								
1	Main Incomer	19.8	20	15.1	16.5	185sqmm/3.5/AL/1	240	adequate
2	LDB-21	1.7	1.7	9	9.3	16sqmm/3/AL/1	51	adequate
3	LDB-22	4.7	4.8	6.1	6.3	16sqmm/3/AL/1	51	adequate
4	LDB-23	0.93	0.93	11.1	12.6	16sqmm/3/AL/1	51	adequate
5	LDB-24	3.1	3.1	15.1	15.8	16sqmm/3/AL/1	51	adequate
6	New Store LDB -PDB	6.1	6.2	34.9	35.9	16sqmm/3/AL/1	51	adequate
7	PDB-22	3.5	3.5	7.6	7.9	16sqmm/3/AL/1	51	adequate
8	PDB-23	2.3	2.4	5.2	6.2	16sqmm/3/AL/1	51	adequate

Earthing

SR.NO.	PANEL	RESISTANCE (Ω)	Remark
1	PCC-2 Panel (PC-21)	0.12	Ok
2	HVAC 2 Panel	0.34	Ok
3	KKR Line Panel (PC-21)	0.060	Ok
4	Lighting MLDb-1 (100KVA Stabilizer)	0.41	Ok
5	Lighting MLDb-2 (100KVA Stabilizer)	0.83	Ok
6	Lighting MLDB-2	0.11	Ok

Power Quality table

PDB-01																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	Main incomer PDB-1 Panel (PC-21 Process)	242.9	244.5	420.8	423.6	3.9	4.2	257	273	35	36.7	144.8	154.7	113.6	120.8	0.79	0.8
2	Compressor-1 GA 75	247	248	428	429.8	3.6	4	146.9	151.7	9.1	9.9	84.6	88.3	61.5	62.6	0.81	0.82
3	Maintenance Workshop	246.3	247	426.4	427.8	4.4	4.7	11.7	11.8	10.6	14.2	5.8	5.8	5.9	6	0.7	0.7
4	MPC-1000	246.3	248.2	426.5	429.8	4	4.8	230.5	245.3	42	44.6	126.4	135.4	108.4	115	0.76	0.77
5	Server room AC	246.7	248	427.4	429.5	3.8	4	15.8	27.9	52.7	55	12.2	15.1	4.9	5.7	0.91	0.92
6	Site office	247.3	248	428.3	429.7	4.5	4.9	6.5	6.5	26.1	35.9	2.1	2.2	1.1	1.6	0.87	0.88
MPC-1000																	
1	200KVA UPS input	242.7	244.9	420.3	424.2	3.2	3.5	232.2	249.3	41.7	43.4	123.1	132.9	107.9	115.7	0.75	0.76
2	200KVA UPS output	230.5	230.6	399.1	399.3	0.5	0.7	203.7	219.6	8.2	9.6	115.3	124.6	65.7	73.2	0.87	0.88

Cable validation

PDB-01									
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK	
		Avg	Max	Avg	Max				
1	Main incomer PDB-1 Panel (PC-21 Process)	257	273	35	36.7	240sqmm/3.5/AL/3	840	adequate	
2	Compressor-1 GA 75	146.9	151.7	9.1	9.9	185sqmm/3.5/AL/1	240	adequate	
3	Maintenance Workshop	11.7	11.8	10.6	14.2	16sqmm/3.5/AL/1	51	adequate	
4	MPC-1000	230.5	245.3	42	44.6	185sqmm/3.5/AL/2	480	adequate	
5	Server room AC	15.8	27.9	52.7	55	70sqmm/3.5/AL/1	130	adequate	
6	Site office	6.5	6.5	26.1	35.9	16sqmm/3.5/AL/1	51	adequate	

Earthing

PANEL	RESISTANCE (Ω)	Remark
PDB-1 Panel (PC-21)	0.078	Ok
200KVA UPS	0.029	Ok

Power Quality table for sub feeders of PC 21 contd.

Utility Old panel																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	Utility Old panel Main incomer	243.8	245	422.8	424.8	4	4.7	145	158.9	9.4	12.9	88.3	95.7	51.7	60.4	0.86	0.87
2	42.Compressor 2GA 75	244.9	246.6	424.5	427.5	3.7	4.2	136.4	139.7	9.2	10.2	82.7	85.2	47.9	49.9	0.86	0.88

Cable validation

Utility Old panel									
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK	
		Avg	Max	Avg	Max				
1	Utility Old panel Main incomer	145	158.9	9.4	12.9	300sqmm/3.5/AL/2	630	adequate	
2	42.Compressor 2GA 75	136.4	139.7	9.2	10.2	185sqmm/3.5/AL/1	240	adequate	

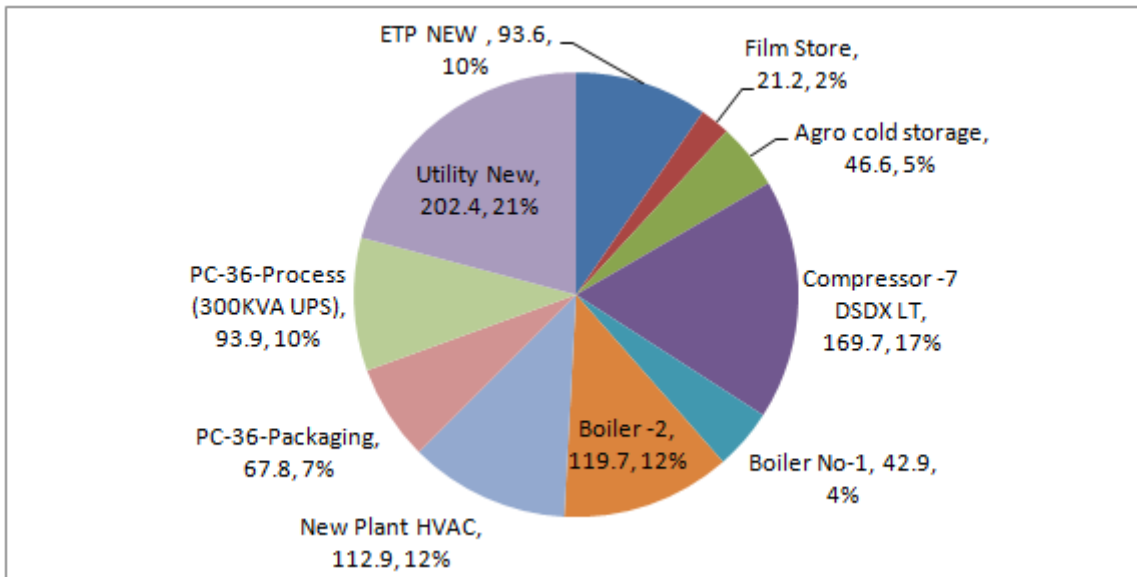
Earthing

PANEL	RESISTANCE (Ω)	Remark
Utility OLD Panel (PC-21)	0.12	Ok

Transformer -2 – 2MVA (PC-36) LT Panel

Power Quality table

Tr-2 (PC-36)																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	Main incomer Tr-2	241	245.9	415.6	424.5	2.7	3.6	1485	1844	4.3	11.2	1050	1212	168.4	353	0.99	0.995
2	ETP NEW	239	240.2	413.4	415.8	2.9	3.3	163.4	168.2	4.9	5.6	91.2	93.6	66.6	69.1	0.81	0.81
3	Film Store	238.8	240.3	412.9	415.4	2.8	3.2	9.3	47.6	2	23.5	3.1	21.2	1.3	25.2	0.85	0.88
4	Agro cold storage	238.9	240.3	413.2	415.9	3	3.4	85	94.8	17.4	20.4	41.5	46.6	36.2	40.3	0.74	0.78
5	Compressor -7 DSDX LT	238.2	239.1	411.9	413.6	2.9	3.3	301.1	307.4	5.1	5.9	167.6	169.7	125.8	129.5	0.8	0.81
6	Boiler No-1	238.3	239.6	411.9	414.1	1.8	2.2	90.7	103.5	5.9	6.8	41.2	42.9	39.2	42	0.72	0.73
7	Boiler -2	240.6	242.5	415.1	418.3	1.5	1.8	150.4	243.5	15.4	26.4	82.5	119.7	62.2	132.7	0.8	0.84
8	New Plant HVAC	239.3	241.6	413	417.1	1.9	2.5	208.3	230.1	2.9	4.1	101.1	112.9	100.6	108.7	0.71	0.72
9	PC-36-Packaging	237.7	239.5	410.9	414.1	1.7	2.1	131.6	146.3	13.1	14	60.1	67.8	56.6	62.4	0.73	0.74
10	PC-36-Process (300KVA UPS)	237.9	239.2	412	414.2	1.7	2.1	132.6	178.8	24.7	26.4	66.5	93.9	58.8	75.7	0.75	0.78
11	Utility New	235.9	237.8	407.4	410.9	1.8	2.2	329.5	333.8	3.2	3.9	200.7	202.4	105.7	107.2	0.88	0.89



- This transformer appears to be catering to 1200KW load. Out of this Agro cold storage (46KW), Boiler 2(119KW), PC 36 (93KW) appear to be major non linear loads aggregating to 258KW. This load is around 21%.
- You may think about installing 50A active harmonic filters across main incomers of above feeders to reduce harmonic stress on cables and also to reduce associated electrical interference in rest of the electrical distribution.
- PC 36 main LT panel breaker busbar nut bolts are loose.
- Main breaker Y phase panel side temperature is high – refer IR thermography report.
- Compressor -7 DSDX – 302L – Y Phase top side, R and B phase bottom side busbar bolts loose – refer IR thermography report.

Cable validation

Tr-2 (PC-36)								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	Main incomer Tr -2	1485	1844	4.3	11.2			
2	ETP NEW	163.4	168.2	4.9	5.6	300sqmm/3.5/AL/2	630	adequate
3	Film Store	9.3	47.6	2	23.5	300sqmm/3.5/AL/3	945	adequate
4	Agro cold storage	85	94.8	17.4	20.4	300sqmm/3.5/AL/2	630	adequate
5	Compressor -7 DSDX LT	301.1	307.4	5.1	5.9	185sqmm/3.5/AL/2	480	adequate
6	Boiler No-1	90.7	103.5	5.9	6.8	300sqmm/3.5/AL/2	630	adequate
7	Boiler -2	150.4	243.5	15.4	26.4	240sqmm/3.5/AL/3	840	adequate
8	New Plant HVAC	208.3	230.1	2.9	4.1	300sqmm/3.5/AL/3	945	adequate
9	PC-36-Packaging	131.6	146.3	13.1	14	240sqmm/3.5/AL/1	280	adequate
10	PC-36-Process (300KVA UPS)	132.6	178.8	24.7	26.4	240sqmm/3.5/AL/2	560	adequate
11	Utility New	329.5	333.8	3.2	3.9	300sqmm/3.5/AL/3	945	adequate

Earthing

PANEL	RESISTANCE (Ω)	Remark
Main LT Panel PC-36	0.70	Ok
	0.017	Ok

Power Quality table

ETP NEW																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	ETP NEW MAIN INCOMER	240.17	241.6	413.82	416.4	2.61	3	149.1	168.6	4.39	11	82.53	94.07	65.05	72.88	0.785	0.798
2	ETP Air Blower	240.33	241.5	414.14	416.2	2.59	2.8	62.67	62.97	2.89	3.3	35.26	35.33	25.22	25.51	0.813	0.817
3	Intermediat clarifier feed pump	236.13	237.2	409.34	411.4	2.63	3	8	8.1	3.16	3.6	4.13	4.21	3.66	3.72	0.747	0.759
4	Trickling filter pump	237.29	238.6	409.58	411.7	2.5	2.7	30.05	30.35	4.77	5.5	17.28	17.4	11.4	11.49	0.835	0.836
5	West Water Pump	236.94	237.6	410.74	411.9	2.44	2.7	9.31	9.48	3.56	4	4.79	4.92	4.28	4.34	0.746	0.752
6	Trickling filter fan no.2	238.17	238.7	412.12	413.1	2.57	2.7	1.26	1.27	3.95	4.3	0.687	0.699	0.547	0.55	0.782	0.787
7	Trickling filter fan no.5	237.01	237.2	411.06	411.4	2.47	2.6	1.21	1.22	3.66	3.9	0.634	0.639	0.533	0.534	0.766	0.767
8	Trickling filter fan no.6	238.15	238.7	412.8	413.7	2.69	2.9	1.17	1.19	4.31	4.6	0.647	0.662	0.536	0.54	0.769	0.774
9	Trickling filter fan no.7	237.94	238.2	412.47	412.8	2.37	2.6	1.21	1.22	3.84	4.2	0.642	0.648	0.532	0.534	0.769	0.773
10	Trickling filter fan no.9	239.05	239.5	414.29	415	2.6	2.7	1.11	1.12	5.33	5.6	0.568	0.576	0.504	0.506	0.745	0.755
11	Trickling filter fan no.10	238.9	239.1	413.99	414.3	2.69	2.8	1.19	1.2	4.22	4.4	0.599	0.607	0.557	0.559	0.732	0.735

Cable validation

ETP NEW								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	ETP NEW MAIN INCOMER	149.1	168.6	4.39	11	300sqmm/3.5/AL/2	630	adequate
2	ETP Air Blower	62.67	62.97	2.89	3.3	16sqmm/3/AL/2	102	adequate
3	Intermediat clarifier feed pump	8	8.1	3.16	3.6	4sqmm/3/CU/1	28	adequate
4	Trickling filter pump	30.05	30.35	4.77	5.5	16sqmm/3/AL/2	102	adequate
5	West Water Pump	9.31	9.48	3.56	4	4sqmm/3/CU/1	28	adequate
6	Trickling filter fan no.2	1.26	1.27	3.95	4.3	4sqmm/3/CU/1	28	adequate
7	Trickling filter fan no.5	1.21	1.22	3.66	3.9	4sqmm/3/CU/1	28	adequate
8	Trickling filter fan no.6	1.17	1.19	4.31	4.6	4sqmm/3/CU/1	28	adequate
9	Trickling filter fan no.7	1.21	1.22	3.84	4.2	4sqmm/3/CU/1	28	adequate
10	Trickling filter fan no.9	1.11	1.12	5.33	5.6	4sqmm/3/CU/1	28	adequate
11	Trickling filter fan no.10	1.19	1.2	4.22	4.4	4sqmm/3/CU/1	28	adequate

Earthing

PANEL	RESISTANCE (Ω)	Remark
ETP New panel (PC-36)	0.052	Ok

Power Quality table

Agro cold storage																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	Agro cold storage Main incomer	234.25	240.2	412.41	418.5	2.82	3.6	93.87	110.7	15.08	17.7	48.38	52.32	37.23	50.42	0.792	0.852
2	LDB	238.7	240	403.75	408.5	3.1	3.5	2.35	2.36	33.86	34.3	0.959	0.984	-0.398	-0.299	0.878	0.88
3	Long term cold storage-I	240.7	242.1	413.6	416.1	2.8	3	20.6	20.7	3.5	3.9	10.3	10.3	9.7	9.8	0.73	0.73
4	Long term cold storage-II	240.5	242.4	413.4	416.8	2.8	3.3	21.8	22	3.5	4	11	11.2	10	10.2	0.74	0.75
5	SPDB	239	240.2	410.4	412	2.9	3.1	29.4	40	39	39.8	17.8	20.9	3	4.8	0.97	0.98

Cable validation

Agro cold storage								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	Agro cold storage Main incomer	93.87	110.7	15.08	17.7	300sqmm/3.5/AL/2	630	adequate
2	LDB	2.35	2.36	33.86	34.3	16sqmm/3.5/AL/1	51	adequate
3	Long term cold storage-I	20.6	20.7	3.5	3.9	16sqmm/3.5/AL/1	51	adequate
4	Long term cold storage-II	21.8	22	3.5	4	16sqmm/3.5/AL/1	51	adequate
5	SPDB	29.4	40	39	39.8	16sqmm/3.5/AL/1	51	adequate

Earthing

PANEL	RESISTANCE (Ω)	Remark
Agro cold storage panel (PC-36)	0.014	Ok

Power Quality table

Boiler no-1																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	Boiler No-1 Main Incomer	238.3	239.6	411.9	414.1	1.8	2.2	90.7	103.5	5.9	6.8	41.2	42.9	39.2	42	0.72	0.73
2	bucket elevator	239.8	240.2	413.9	414.5	1.6	1.8	3.9	4	4.3	5	1	1.1	2.6	2.6	0.37	0.38
3	Cooling Tower	240.3	240.9	414.8	415.9	1.8	2	11.7	11.8	4.1	4.5	5.2	5.3	6.5	6.6	0.63	0.63
4	Crusher	240	240.6	414.2	415.4	1.8	2	7.8	14.3	97.3	106.6	3.6	7.4	-1.1	-2.7	0.7	0.67
5	DE System	239	239.7	412.6	413.8	1.5	1.7	10.2	10.3	1.8	2.4	4.9	4.9	5.3	5.3	0.68	0.68
6	drag chain	239.5	239.9	413.2	414	1.6	1.8	7.7	8	1.8	2.2	2.7	3.1	4.7	4.8	0.49	0.54
7	Lighting Load	239.6	239.9	413.5	414.2	1.8	2	17.5	17.6	19.5	20.3	6.2	6.2	1.6	1.6	0.97	0.97
8	Moving Floor	241.4	242.6	416.4	418.6	1.8	2	37.9	39.4	5.4	6.2	18.4	19.7	19.6	19.9	0.68	0.71
9	roof extractor for boiler	240.2	240.6	414.5	415.1	1.6	1.7	2.5	2.5	1.1	1.2	1.2	1.2	1.2	1.3	0.69	0.7
10	roof extractor for boiler-1	241.3	241.7	416.4	417	1.6	1.8	4.6	4.6	0.9	1	2.6	2.6	2.1	2.1	0.78	0.78
11	screw conveyor	241.3	241.5	416.3	416.6	1.7	1.9	6.9	6.9	2	2.2	1.5	1.6	4.7	4.7	0.3	0.33
12	Silo panel	238.9	239.5	412.4	413.4	1.8	2.1	12.9	13	3.1	3.5	6.4	6.5	6.5	6.6	0.7	0.71

Cable validation

Boiler no-1								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	Boiler No-1 Main Incomer	90.7	103.5	5.9	6.8	300sqmm/3.5/AL/2	630	adequate
2	bucket elevator	3.9	4	4.3	5	4sqmm/4/AL/1	23	adequate
3	Cooling Tower	11.7	11.8	4.1	4.5	16sqmm/3.5/AL/1	51	adequate
4	Crusher	7.8	14.3	97.3	106.6	16sqmm/3.5/AL/1	51	adequate
5	DE System	10.2	10.3	1.8	2.4	16sqmm/4/AL/1	51	adequate
6	drag chain	7.7	8	1.8	2.2	4sqmm/4/AL/1	23	adequate
7	Lighting Load	17.5	17.6	19.5	20.3	16sqmm/3.5/AL/2	102	adequate
8	Moving Floor	37.9	39.4	5.4	6.2	50sqmm/3.5/AL/1	105	adequate
9	roof extractor for boiler	2.5	2.5	1.1	1.2	4sqmm/4/AL/1	23	adequate
10	roof extractor for boiler-1	4.6	4.6	0.9	1	4sqmm/4/AL/1	23	adequate
11	screw conveyor	6.9	6.9	2	2.2	4sqmm/4/AL/1	23	adequate
12	Silo panel	12.9	13	3.1	3.5	16sqmm/4/AL/1	51	adequate

Earthing

PANEL	RESISTANCE (Ω)	Remark
Boiler 1 Panel (PC-36)	0.056	Ok

Power Quality table

Boiler no-2																		
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF		
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	
1	Main Incomer	240	241.7	412.1	415.3	2.6	2.9	221.7	228	19.5	20.5	131	134.6	78.8	80.1	0.86	0.86	
2	Feed water pump-2	236.3	237.2	406	407.6	2.1	2.3	64.5	69.3	5.1	5.6	38.9	41.8	16.7	17.6	0.92	0.92	
3	ID Fan	240	241.5	412	414.6	2.7	2.9	91.2	95	71.6	74.4	51.4	53.7	38.7	39.9	0.8	0.81	
4	Primary air fan	236.7	237	406.3	407	2.7	2.7	39.3	39.9	7.8	8.2	14.9	15.1	10.5	10.6	0.82	0.82	
5	secondary air fan	237.1	237.4	407	407.7	2.4	2.7	25.2	25.7	9.3	10.4	10.3	10.4	13.9	14	0.59	0.6	

Cable validation

Boiler no-2								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	Main Incomer	221.7	228	19.5	20.5	240sqmm/3.5/AL/3	840	adequate
2	Feed water pump-2	64.5	69.3	5.1	5.6	25sqmm/4/AL/2	140	adequate
3	ID Fan	91.2	95	71.6	74.4	95sqmm/3.5/AL/2	310	adequate
4	Primary air fan	39.3	39.9	7.8	8.2	25sqmm/4/AL/2	140	adequate
5	secondary air fan	25.2	25.7	9.3	10.4	16sqmm/4/AL/2	102	adequate
6	Great ash raly		1.5			2.5sqmm/3/AL/1	18	adequate
7	Great ash screw		1.8			2.5sqmm/3/AL/1	18	adequate
8	Ralv-MDC		1.1			2.5sqmm/3/AL/1	18	adequate
9	Ralv-SSK		1.4			2.5sqmm/3/AL/1	18	adequate
10	SSK-1		1.1			2.5sqmm/3/AL/1	18	adequate
11	SSK-2		1.7			2.5sqmm/3/AL/1	18	adequate
12	SSK-3		2			2.5sqmm/3/AL/1	18	adequate
13	SSK-4		1.4			2.5sqmm/3/AL/1	18	adequate
14	Feeding screw silo		1.1			2.5sqmm/3/AL/1	18	adequate
15	Hydraulic pump		1.4			2.5sqmm/3/AL/1	18	adequate
16	SSK Hooper		1.6			2.5sqmm/3/AL/1	18	adequate

Earthing

PANEL	RESISTANCE (Ω)	Remark
Boiler 2 Panel (PC-36)	0.24	Ok

Power Quality table

New Plant HVAC																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	New Plant HVAC Main Incomer	237.7	243.6	411	420.9	2.8	3.3	178	232	4.3	5.3	84	110.3	86.3	119.1	0.7	0.71
2	Main Plant RHS	239.2	240.6	412.4	415	2.6	3	31.5	31.8	4	5.4	12.8	12.9	17.2	17.5	0.59	0.6
3	Main Plant LHS	236.8	238	408.1	410.5	2.5	2.9	42.8	46.4	4.7	5.4	18.4	20	22.6	25.5	0.63	0.64
4	Main plant central area	238.4	243.3	410.9	419.5	2.6	3	154.4	169.4	4.4	8.1	80	88.3	71.1	79.1	0.75	0.77
Main plant central area																	
1	Main Incomer	238.4	243.3	410.9	419.5	2.6	3	154.4	169.4	4.4	8.1	80	88.3	71.1	79.1	0.75	0.77
2	Fan 8 Roof Extractor	239.1	239.9	412.7	414	2.2	2.4	2.3	2.4	2.4	2.6	0.607	0.62	-1.6	-1.6	0.36	0.37
3	Fan-04	242.1	242.7	417.3	418.4	2.7	2.9	4.8	4.8	3.2	3.3	1.4	1.4	-3.1	-3.1	0.4	0.4
4	Fan-05	241.8	242.2	416.7	417.5	2.9	3	4	4	4.3	4.5	1.7	1.7	-2.2	-2.3	0.6	0.59
5	Fan-06	238.8	239.2	412.1	412.7	2.2	2.4	2.3	2.4	2.6	2.7	1.1	1.1	1.3	1.3	0.64	0.64
6	Fan-07	242.5	242.8	417.9	418.7	3	3.2	2.4	2.4	3.3	3.5	1.1	1.1	1.3	1.3	0.65	0.65
7	Fan-11	240.6	240.9	414.7	415.2	2.8	2.9	2.2	2.2	3.4	3.7	0.989	1	1.2	1.2	0.64	0.65
8	Fan-12	240.8	242.3	415.2	417.7	2.5	2.7	2.9	2.9	3.2	3.5	1.5	1.5	1.4	1.4	0.72	0.73
9	Heat Exchanger	238.4	238.9	411.4	412.4	2.2	2.4	2.4	2.4	1.6	1.7	0.96	0.965	1.3	1.3	0.58	0.58
10	Monitor-1	238.7	239.5	412.9	414	2.3	2.4	2.5	2.5	2.7	2.9	0.296	0.303	-1.7	-1.7	0.17	0.17
11	Monitor-2	238.3	238.9	411.9	413	2.4	2.8	2.9	2.9	3.3	3.7	0.367	0.378	-2	-2	0.18	0.18
12	Monitor-4	238.3	239.1	411.3	412.5	2.4	2.5	3.2	3.2	2.9	3.1	0.395	0.407	-2.2	-2.2	0.17	0.18
13	Monitor-5	238.8	239.4	412.2	413.2	2.4	2.6	3.2	3.2	3.2	3.4	1.7	1.7	1.4	1.4	0.76	0.77
14	Monitor-7	239.6	240.5	413.3	414.8	2.4	2.5	2.6	2.6	3.6	3.8	0.754	0.772	-1.6	-1.6	0.42	0.43
15	Roof Extractor 03	239.7	240.1	413.5	414.2	2.1	2.3	2.5	2.5	3	3.3	1.5	1.5	0.851	0.855	0.87	0.87
16	Ventilation LHS	238.7	240.4	412.8	415.5	2.7	3.1	22.2	22.6	4.3	5.1	11.6	11.7	10.1	10.4	0.75	0.76
17	Ventilation RHS	239.4	241	413.9	416.5	2.5	2.8	34	34.6	5.6	7	19.4	19.7	13.7	14	0.82	0.82
18	WIP Supply Fan	241.3	241.8	416	417	2.3	2.6	2.9	2.9	1.3	1.4	1.6	1.7	1.3	1.3	0.79	0.79
19	WIT Seasoning	241.9	242.5	417.1	418.2	2.7	2.9	1.4	1.4	5.5	6.5	0.451	0.454	0.875	0.882	0.46	0.46
20	optex chiller	236.9	238.4	408.3	411.2	2.6	3	8.6	8.6	7.4	8.8	3.1	3.1	2.5	2.6	0.77	0.78
21	Panel Room AC	238.6	239.6	411.3	413.1	2.7	2.9	19.7	19.9	7.7	13.6	8.4	8.4	7.5	7.6	0.74	0.75
22	Press Room	240.2	240.9	414.1	415.4	2.6	2.8	1.3	8.7	3.3	147.7	0.64	4.5	0.65	4.3	0.64	0.82
23	starch pump no-2	237.3	238.9	409.1	411.9	2.6	3	29.7	36.5	4.8	6.6	16.3	20.6	12.3	16.9	0.8	0.82

Cable validation

New Plant HVAC								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	New Plant HVAC Main Incomer	178	232	4.3	5.3	300sqmm/3.5/AL/3	945	adequate
2	Main Plant RHS	31.5	31.8	4	5.4	185sqmm/3.5/AL/1	240	adequate
3	Main Plant LHS	42.8	46.4	4.7	5.4	185sqmm/3.5/AL/1	240	adequate
4	Main plant central area	154.4	169.4	4.4	8.1	300sqmm/3.5/AL/2	630	adequate
Main plant central area								
1	Main Incomer	154.4	169.4	4.4	8.1	300sqmm/3.5/AL/2	630	adequate
2	Fan 8 Roof Extractor	2.3	2.4	2.4	2.6	2.5sqmm/3/AL/1	18	adequate
3	Fan-04	4.8	4.8	3.2	3.3	2.5sqmm/3/AL/1	18	adequate
4	Fan-05	4	4	4.3	4.5	2.5sqmm/3/AL/1	18	adequate
5	Fan-06	2.3	2.4	2.6	2.7	2.5sqmm/3/AL/1	18	adequate
6	Fan-07	2.4	2.4	3.3	3.5	2.5sqmm/3/AL/1	18	adequate
7	Fan-11	2.2	2.2	3.4	3.7	2.5sqmm/3/AL/1	18	adequate
8	Fan-12	2.9	2.9	3.2	3.5	2.5sqmm/3/AL/1	18	adequate
9	Heat Exchanger	2.4	2.4	1.6	1.7	2.5sqmm/3/AL/1	18	adequate
10	Monitor-1	2.5	2.5	2.7	2.9	2.5sqmm/3/AL/1	18	adequate
11	Monitor-2	2.9	2.9	3.3	3.7	2.5sqmm/3/AL/1	18	adequate
12	Monitor-4	3.2	3.2	2.9	3.1	2.5sqmm/3/AL/1	18	adequate
13	Monitor-5	3.2	3.2	3.2	3.4	2.5sqmm/3/AL/1	18	adequate
14	Monitor-7	2.6	2.6	3.6	3.8	2.5sqmm/3/AL/1	18	adequate
15	Roof Extractor 03	2.5	2.5	3	3.3	2.5sqmm/3/AL/1	18	adequate
16	Ventilation LHS	22.2	22.6	4.3	5.1	16sqmm/3/AL/1	51	adequate
17	Ventilation RHS	34	34.6	5.6	7	16sqmm/3/AL/1	51	adequate
18	WIP Supply Fan	2.9	2.9	1.3	1.4	2.5sqmm/3/AL/1	18	adequate
19	WIT Seasoning	1.4	1.4	5.5	6.5	2.5sqmm/3/AL/1	18	adequate
20	optex chiller	8.6	8.6	7.4	8.8	2.5sqmm/3/AL/1	18	adequate
21	Press Room	1.3	8.7	3.3	147.7	2.5sqmm/3/AL/1	18	adequate
22	starch pump no-2	29.7	36.5	4.8	6.6	10sqmm/3/AL/1	40	adequate

Earthing

PANEL	RESISTANCE (Ω)	Remark
New Plant HVAC Panel	0.054	Ok

Power Quality table

Utility New																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	Utility New Main Incomer	235.9	237.8	407.4	410.9	1.8	2.2	329.5	333.8	3.2	3.9	200.7	202.4	105.7	107.2	0.88	0.89
2	43-Compressor-3-GA-110	242.1	243.5	417.9	420.3	1.6	2.2	180.2	184.4	2.9	3.6	113.5	115.9	56.1	57.1	0.9	0.9
3	compressor-5-GA-75	242.1	243.5	417.9	420.3	1.6	2.2	135.2	137.2	3.8	5.1	82.3	83.2	51.1	51.9	0.85	0.85

Cable validation

Utility New									
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK	
		Avg	Max	Avg	Max				
1	Utility New Main Incomer	329.5	333.8	3.2	3.9	300sqmm/3.5/AL/3	945	adequate	
2	43-Compressor-3-GA-110	180.2	184.4	2.9	3.6	185sqmm/3.5/AL/1	240	adequate	
3	compressor-5-GA-75	135.2	137.2	3.8	5.1	185sqmm/3.5/AL/1	240	adequate	

Earthing

PANEL	RESISTANCE (Ω)	Remark
Utility MCC Panel (PC-36)	0.26	Ok

Power Quality table

PC-36 Packaging																	
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
1	160KVA UPS input	262.2	265.5	446.2	451.2	2.1	2.7	108.3	135.3	12.8	15.4	53.6	68.9	54	65.4	0.7	0.72
2	160KVA UPS output	230.5	230.7	399.1	399.4	0.5	0.6	85.5	108.8	18.9	27.2	47	61.1	21.7	27.5	0.9	0.95

Cable validation

PC-36 Packaging								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	160KVA UPS input	108.3	135.3	12.8	15.4	300sqmm/3.5/AL/1	315	adequate

Earthing

PANEL	RESISTANCE (Ω)	Remark
160KVA UPS	0.047	Ok

Power Quality table

PC-36 Process																		
Sr.No	Feeder Name	L-N Voltage		Line Voltage		Voltage THD%		Line Current		Current THD%		KW		KVAR		PF		
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	
1	300KVA UPS Input	239.6	241.6	413.4	417.1	1.2	1.5	137.9	303.1	22.5	25.2	69.9	166.4	62.9	127.6	0.74	0.79	
2	300KVA UPS output	228	228.4	394.9	395.6	0.6	0.7	110.1	321	25.5	37.9	61.9	152.4	36.1	149.8	0.86	0.88	

Cable validation

PC-36 Process								
Sr.No	Feeder Name	Line Current		Current THD%		Cable	Cable current capacity (amps)	REMARK
		Avg	Max	Avg	Max			
1	300KVA UPS Input	137.9	303.1	22.5	25.2	300sqmm/3.5/AL/2	630	adequate

Earthing

PANEL	RESISTANCE (Ω)	Remark
300KVA UPS	0.01	Ok

Panel Earthing test results using loop earth test method

SR.NO.	PANEL	RESISTANCE (Ω)	Remark
1	PC-36 Transformer Body Earth	0.023	Ok
2	PC-36 Transformer Neutral	0.026	Ok
3	PC-21 Transformer Body Earth	0.28	Ok
4	PC-21 Transformer Neutral	0.30	Ok
5	Process panel (PC-36)	1.6	Ok
6	Packaging panel (PC-36)	0.047	Ok
7	APFC Panel (PC-36)	0.11	Ok
8	Biogas engine auxiliary panel	0.041	Ok
9	Biogas main supply Panel	0.19	Ok
10	LA Earthing	0.011	Ok
11	LPG Yard (Tank no.1)	0.082	Ok
12	LPG Yard (Tank no.2)	0.13	Ok
13	LPG Yard (Tank no.3)	0.059	Ok
14	HSD Yard (Tank no.1)	0.013	Ok
15	HSD Yard (Tank no.2)	0.35	Ok
16	HSD Yard (Tank no.3)	0.15	Ok
17	Kurkure UPS panel	0.12	Ok
18	Individual machine Packaging	0.3	Ok
19	Pc.21 Packaging panel	0.26	Ok
20	KKR Packaging panel	0.41	Ok
21	BCP/TWZ Packaging Panel	0.2	Ok
22	PC-36 Packaging Panel	0.42	Ok

Earth Pit Testing using fall of potential method.

EARTH PIT TESTING				
Pepsico India Holdings Pvt Ltd				Date:- 16.12.2016
Sr. No	Location	Earth Pit No	Values Ohm	Earthing Strip/Material
1	Packaging M/C	Earth Pit - 02	0.6	JI 50 X 5
2	BCP Line	Earth Pit - 03	0.8	JI 50 X 5
3	Packaging Line	Earth Pit - 04	0.5	JI 50 X 5
4	PCC Panel	Earth Pit - 05	0.3	JI 50 X 5
5	PCC Panel	Earth Pit - 06	0.4	JI 50 X 5
6	HT Breker	Earth Pit - 07	0.3	JI 50 X 5
7	Transformer -1 N-1	Earth Pit - 08	0.8	JI 50 X 5
8	Transformer -1 N-2	Earth Pit - 09	0.6	JI 50 X 5
9	Transformer -1 B-1	Earth Pit - 10	0.5	JI 50 X 5
10	Transformer -1 B-1	Earth Pit - 11	0.7	JI 50 X 5
11	Transformer -1 B-2	Earth Pit - 12	0.8	JI 50 X 5
12	Transformer -1 B-1	Earth Pit - 13	0.3	JI 50 X 5
13	DG-1 N-1	Earth Pit - 14	0.8	JI 50 X 5
14	PCC-2	Earth Pit - 15	0.6	JI 50 X 5
15	HT Panel-2	Earth Pit - 16	0.3	JI 50 X 5
16	DG-2 N-1	Earth Pit - 17	0.4	JI 50 X 5
17	DG-2 N-2	Earth Pit - 18	0.4	JI 50 X 5
18	DG 2 B-2	Earth Pit - 19	0.6	JI 50 X 5
19	DG 2 B-1	Earth Pit - 20	0.7	JI 50 X 5
20	DG 2 B-2	Earth Pit - 21	0.4	JI 50 X 5
21	DG 2 B-1	Earth Pit - 22	0.3	JI 25 X 5
22	Kurkure Line	Earth Pit - 23	0.5	JI 50 X 5
23	DG -1 N-2	Earth Pit - 24	0.7	JI 50 X 5
24	Motor	Earth Pit - 25	0.5	Copper 50 X 5
25	Fire Pump	Earth Pit - 26	0.4	Copper 50 X 5
26	Fire Pump	Earth Pit - 27	0.3	Copper 50 X 5
27	Fire Engine	Earth Pit - 28	0.3	Copper 50 X 5
28	KIOSK-2 PT -3	Earth Pit - 29	0.2	Copper 50 X 5
29	KIOSK-2 PT -2	Earth Pit - 30	0.4	Copper 50 X 5
30	KIOSK-2 PT -1	Earth Pit - 31	0.5	Copper 50 X 5
31	KIOSK-2 CT-1	Earth Pit - 32	0.7	Copper 50 X 5
32	KIOSK-2 CT-2	Earth Pit - 33	0.3	Copper 50 X 5
33	KIOSK-2 CT-3	Earth Pit - 34	0.5	Copper 50 X 5
34	KIOSK-2 B-2	Earth Pit - 35	0.6	Copper 50 X 5
35	KIOSK-2 B-1	Earth Pit - 36	0.4	Copper 50 X 5
36	HT Cable	Earth Pit - 37	0.6	Copper 50 X 5
37	Fencing-1	Earth Pit - 38	0.9	Copper 50 X 5
38	Fencing-2	Earth Pit - 39	0.4	Copper 50 X 5
39	HT Cable	Earth Pit - 40	0.5	Copper 50 X 5
40	Fire Engine	Earth Pit - 41	0.3	JI 50 X 5
41	Motor	Earth Pit - 42	0.3	JI 50 X 5
42	Motor	Earth Pit - 43	0.5	JI 50 X 5
43	Fire Panel	Earth Pit - 44	0.3	JI 50 X 5
44	Fire Panel	Earth Pit - 45	0.7	JI 50 X 5
45	Fire Engine	Earth Pit - 46	0.4	JI 50 X 5
46	Fire Engine (25 to 55)	Earth Pit - 47	0.3	Copper 25 X 5
47	Packaging M/C	Earth Pit - 48	0.7	Copper 25 X 5
48	EPABX/Greyer	Earth Pit - 49	0.3	Copper 25 X 5
49	EPABX/Greyer	Earth Pit - 50	0.2	Copper 25 X 5
50	RBS Panel -2	Earth Pit - 51	0.5	JI 50 X 5

EARTH PIT TESTING				
Pepsico India Holdings Pvt Ltd				Date:- 16.12.2016
Sr. No	Location	Earth Pit No	Values Ohm	Earthing Strip/Material
51	RBS Panel -1	Earth Pit - 52	0.3	Copper cable 35 sqmm
52	LPG 2	Earth Pit - 53	0.4	JI 50 X 5
53	PC 36 UPS	Earth pit no - 54	0.8	JI 50 X 5
54	ETP-1	Earth pit no - 55	0.5	JI 50 X 5
55	PC 36 UPS Panel - 3	Earth pit no - 56	0.5	JI 50 X 5
56	HSD Tank - 1	Earth pit no - 57	0.6	JI 50 X 5
57	HSD Tank - 2	Earth pit no - 58	0.7	JI 50 X 5
58	HSD Tank - 3	Earth pit no - 59	0.8	JI 50 X 5
59	PC 36 UPS - 3	Earth pit no - 60	0.7	JI 50 X 5
60	ETP- 2	Earth pit no - 61	0.4	JI 50 X 5
61	OPP.Substation Side	Earth pit no - 62	0.2	JI 50 X 5
62	LPG Yard	Earth pit no - 63	0.8	JI 50 X 5
63	PM Store - 2	Earth pit no - 64	0.7	JI 50 X 5
64		Earth pit no - 65	0.3	JI 50 X 5
65	RM Store	Earth pit no - 66	0.3	Copper 25 X 5
66		Earth pit no - 67	0.3	Copper 25 X 5
67		Earth pit no - 68	0.4	Copper 25 X 5
68	PC 36 UPS - 3	Earth pit no - 69	0.6	JI 25 X 5
69	HSD Tank - 1	Earth pit no - 70	0.5	JI 25 X 5
70	HSD Tank - 1	Earth pit no - 71	0.3	JI 25 X 5
71	ETP LAB - 1	Earth pit no - 72	0.4	JI 50 X 5
72	Oil Tank - 1	Earth pit no - 73	0.8	JI 50 X 5
73		Earth pit no - 74	0.7	JI 50 X 5
74	Material Gate	Earth pit no - 75	0.4	JI 50 X 5
75	Substation HT Yard	Earth pit no - 76	0.3	Copper 50 X 5
76		Earth pit no - 77	1.6	Copper 50 X 5
77		Earth pit no - 78	1	Copper 50 X 5
78	Substation HT Yard	Earth pit no - 79	0.4	Copper 50 X 5
79	Substation HT Yard	Earth pit no - 80	0.7	Copper 50 X 5
80		Earth pit no - 81	0.3	Copper 50 X 5
81		Earth pit no - 82	0.3	Copper 50 X 5
82		Earth pit no - 83	0.7	Copper 50 X 5
83		Earth pit no - 84	0.4	Copper 50 X 5
84		Earth pit no - 85	0.2	Copper 50 X 5
85	DG Set (1010 kva)	Earth pit no - 86	0.2	Copper 50 X 5
86		Earth pit no - 87	0.5	Copper 50 X 5
87		Earth pit no - 88	0.6	Copper 50 X 5
88		Earth pit no - 89	0.6	Copper 50 X 5
89	Transformer No- 2	Earth pit no - 90	0.3	Copper 50 X 5
90		Earth pit no - 91	0.5	Copper 50 X 5
91	Agro Cooling Fan	Earth pit no - 92	-	Not Checked
92		Earth pit no - 93	-	Not Checked
93		Earth pit no - 94	-	Not Checked
94	Agro Min Gate	Earth pit no - 95	0.4	JI 25 X 5
95	Boiler Area	Earth pit no - 96	0.6	JI 50 X 5
96		Earth pit no - 97	0.8	JI 50 X 5
97		Earth pit no - 98	0.6	JI 50 X 5
98		Earth pit no - 99	0.5	JI 50 X 5
99	ETP - 3	Earth pit no - 100	0.8	JI 50 X 5
100	PM Store	Earth pit no - 101	-	Not Checked
101	Boiler Area	Earth pit no - 102	0.7	JI 50 X 5
102	Boiler Area	Earth pit no - 103	0.3	JI 50 X 5
103	Lightning arrester	Earth pit no - 104	0.3	Copper 25 X 5
104	Lightning arrester	Earth pit no - 105	0.8	Copper 25 X 5

Inspection of lightening arrestor installation:



As per information gathered from plant, lightening arrestor arrangement was supposed to be mounted on chimney, which is tallest structure in premises. On inspection Franklin rod LA was not found on top of chimney, however an earthstrip was found running from top of the chimney to some earthpits.

Total plant area is approximately 60000sq mtrs and requires detail design of lightening arrestor system as per IS 2309. We are submitting the brief design and budgetary expenditure required for the same separately.

We recommend that plant should install such a IS 2309 compliant lightening arrestor system to limit it's liability against any natural disaster. This will also meet various plant and machinery insurance requirements.

Requirements and compliance as per CEA 2010

CEA 2010 is a prevailing electrical safety standard guideline document prepared by Central Electrical Authority – an autonomous body formed by government of India under electricity act 2003 as amended. These guidelines are followed by various related state authorities like MSEDCL and electrical Inspectorate. While sanctioning a new connection, commissioning a new installation or investigating any electrical accident – the authorities are bound by provisions of this document and check compliance as per various clauses in this document.

In view of reducing control of inspectors on compliance, this document suggests “Self declared safety” for industries having connected load more than 250KVA.

Salient Statutory safety requirements along with clause references from statutory document CEA 2010.

- Name of the document: CEA regulation – 20th Sept 2010 – Measures related to safety and electric supply.
- 5.4 – Designated electrical safety officer required. Self declared electrical safety.
- 16.1 – Earthing system with maintainable earth electrodes should be provided.
- 18 - Danger notices are required in Hindi, English and Local language.
- 19 – 5 –Rubber mats of appropriate voltage grade should be provided
- 27 – 1 - Providing Fire buckets with clean dry sand and fire extinguishers
- 27 – 3 – Providing first aid box. Instructions for resuscitation of a person suffering from electric shock and also to have persons trained to undertake resuscitation.
- 41 - Specifies earthing requirements for motors, Neutral earthing.
- 42 – Requirement of Earth leakage protection device
- 45 – protection and interlock requirements from the point of view of safety
- Page 344 onwards – formats of test reports to be maintained periodically,
- CEA 2010 Notification is followed by all states and all authorised DISCOMS.
- Electrical inspectorate is a GOM body which was earlier working under PWD, now works under Energy ministry – also follows CEA 2010.
- Following CEA 2010 limits responsibility of a public organization under any electrical mishaps and also fulfils prerequisites of insurance issues

Considering above we strongly recommend to comply with these requirements and follow all the standards.

Apart from this if Leading Food Industry is following other international safety standards like NFPA 70 or OHSAS, adhering to such compliances is more significant. Apart from such electrical safety audits, these standards require independent ARC FLASH studies to understand energy contents in possible flashovers and select necessary PPEs to avoid damage to humans working on live systems.

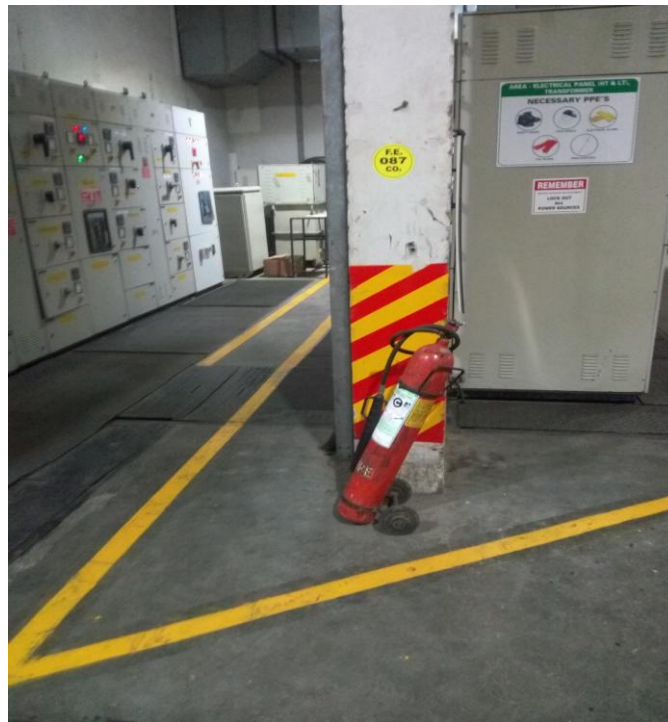
What follows are few observations as per CEA 2010 and associated recommendations.

1) We advise that Company should declare one person as Electrical safety officer with a formal declaration with electrical inspectorate. The detail procedure and prerequisites are available on http://www.cea.nic.in/reports/regulation/regulation_elec_safety.pdf and <http://www.cea.nic.in/reports/others/ps/pce2/cei/regulation.pdf>

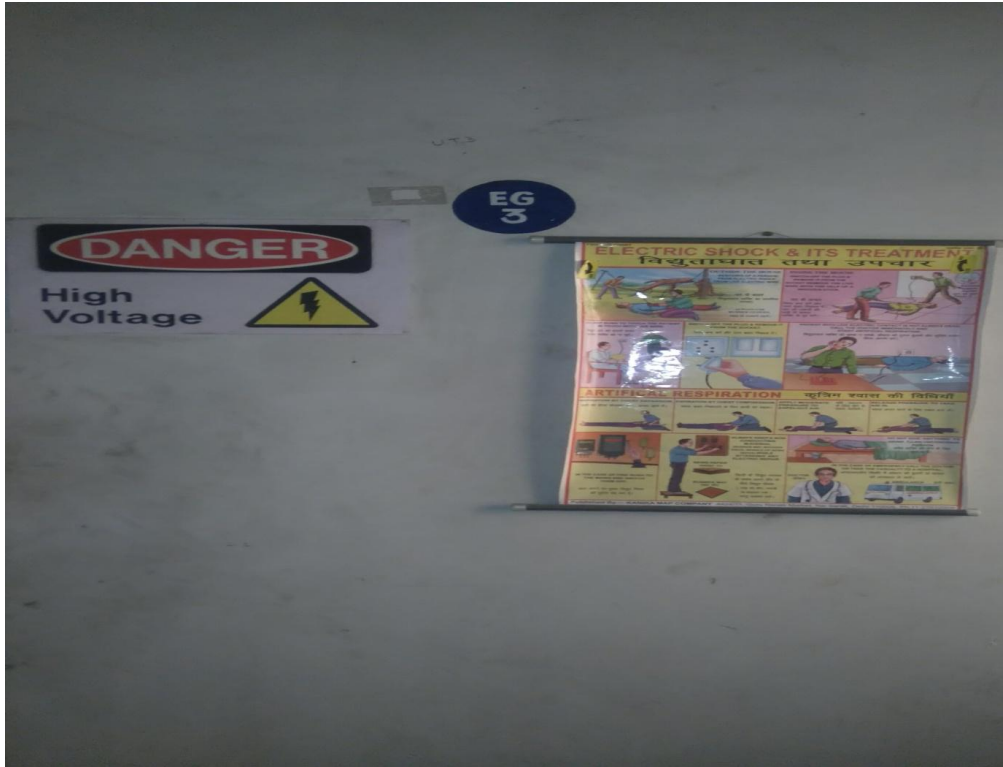
2) Following photograph shows that necessary precautions are taken by providing enough space in front of distribution panels and required rubber mats are also provided. We advise that test reports of such rubber mats should be preserved till their life span



3) PPE use instructions are provided. It is advised that they should be provided in Hindi and Local Language as well. Following photograph shows availability of fire extinguisher. Please preserve test certificates for same.



- 4) Instructions for resuscitation are provided. Please provide danger signs in Hindi and local languages as well



- 5) Following photograph shows that feeder identification is provided clearly on each feeder for easy identification and convenience of operators.



6) Both the transformers appear to be installed with due precautions .

