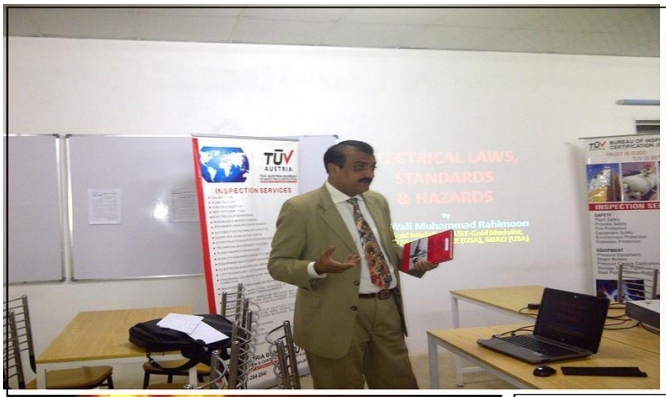
ELECTRICAL INSPECTOR PAKISTAN

(Pvt) Ltd

PROFILE & PROJECTS



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- **IAEI International Association Electrical Inspectors (USA)**

Inspection, Testing and Audit Plan and Audit Activities.

The detailed audit plan along with audit activities adopted is as given below:

Day	Activity	Intended Purpose
1st Day	Opening Meeting with representatives of Management.	To propagate objective of the audit, Discuss detail schedule of the audit, Seek desired co-operation from different sections/departments.
2nd Day	Documents Review	Main purpose is to review the availability of relevant documentation, approvals, Test Reports & Fitness Certificates subsequently it's their authentication.
3rd Day	Walk through visual Inspection & Audit.	Main purpose of walk through audit of Electrical distribution network and gather evidences.
4th-5th Day	Detail Audit of LT, MP & HT Panel Rooms	To conduct detail audit of LT, MP & HT Panel Rooms as per the agreed scope of work & ascertain compliance level)
6th-7th-8th Day	Measurements Tests i.e Earth, Megger, Lux, Cable Locations with Currents, Protection Relay & Thermography.	Measurements, Testing by relevant Testing Equipments, Protection Relay Testing, Cable Locations, subsequently collection of record.
9th Day	Preparation Audit and Inspection Report	Writing Audit and Inspection Report and Classification of NCRs
10th Day	Closing Meeting	To discuss the outcome of the audit report with Management Representatives subsequently corrective actions on observed Non-Compliances.

Documents Review during Inspection, Audit & Testing.

The relevant documents are to be reviewed / checked during the audit and they were also examined for their authenticity, their validity, their updates and their actual usage. A summary on outcome of document verification is being reproduced as below:

S. No.	Document	Availability / Status
a)	SLD (Single Line Diagram) found available on record also approved by the authority, (BS-514.9), NFPA/70E-205.2	**OK**
b)	Fitness Certificate of Transformer found available on record, Rule-62.	**Major**
c)	Fitness Certificates of Gas Generator found available on record. (Section-28, Section-30 & Rule-62).	**OK**
d)	Fitness Certificates of DG-Set Generators found available on record. (Section-28, Section-30 & Rule-62).	**Major**
e)	Fitness Certificate of connected load of Power & Light (800+200=1000KW) found available on record, (Rule-48).	**Major**
f)	Government Licensed Test Report of the connected Load of Power & Light is found available, (Rule-40).	**OK**
g)	List of Electrical Staff is provided also competency certificates verified, Rule-3 (NFPA/70E-205.1)	**OK**
h)	Copies of Paid Electricity Bills of supply company for the last 12-	**Minor**

	Months.	
i)	Copies of Paid Government Treasury Challans of electricity duty on private generators for the last 12-Months payable under Provincial Finance Act.	**Medium**

Visual Inspection & Evidences.

The visual inspection usually carried out for physical check and judgment of maintenance trend of the organization. The main purpose of visual survey is to collect and gather the evidences for audit and assessment to evaluate the ignorance alertness behavior of the maintenance staff.

Insulation Resistance, Megger Testing Survey on Off Load.

Insulation Testing Survey as required under Rule-63 of the Local Electricity Rules-1937 is conducted on Shutdown and Off Load. The megger testing is to be carried-out on four different locations i.e on Load Side, DB's Side, LT Panel Side & finally on HT Side of the Transformer, and subsequently the measurement records are given below;

Location	Phase Location	Value
Incoming Load Cables Coming from DB's	Red Phase & Sheath	40 MΩ
	Yellow Phase & Sheath	40 MΩ
	Blue Phase & Sheath	35 MΩ
	Neutral & Sheath	45 MΩ

Looking to the Pakistan Standards of PSQCA and Electricity Rules 1937, it can be observed from the above table readings that independent cables insulations are within the recommended limits and satisfactory. It is also revealed from good results that the cables are new and of a good quality.

Testing of Earthing System & Lightening Arrester Survey.

Earthing system survey has to be conducted as a part of electrical safety audit. The earthing tests are measured from component to earth source and than from earth source to earth pits. The earth resistance measurements are taken on both the earthing systems and the readings are in the table below.

Location	Earth Pit No.	Result in Ohms	Remarks
Main LT Panel	**EP-1**	**32**	**Not Satisfactory**
Transformer HT Side	**EP-2**	**08**	**Not Satisfactory**
Transformer LT Side	**EP-3**	**6.5**	**Not Satisfactory**
Generator Side	**EP-4**	**3.5**	**Not Satisfactory**
DB Junction-5	**EP-5**	**1.5**	**OK**
DB Junction-6	**EP-6**	**0.5**	**OK**
DB Junction-7	**EP-7**	**0.8**	**OK**
DB Junction-8	**EP-8**	**3.5**	**Not Satisfactory**
DB Junction-9	**EP-9**	**0.9**	**OK**
DB Junction-10	**EP-10**	**0.8**	**OK**

It can be seen from the above table that all earth resistance are not satisfactory, some of above are within the recommended limits, hence need to be improved. Further there is no permanent name plates are

provided to any of the earthing pit.

Cable Load Capacity, Leakage & DB Schedule on Full Load.

Current studies used to be carried out on full load for cables, circuit breakers and Leakage Current Survey is also conducted during the audit and the measurement records are given below in DB's schedules survey, which are less than 1/5000 part of total current passing permissible under Rule-26 of the Local Electricity Rules, Hence leakage current measured at DBs boxes and LT Panels & Earth pits is within the recommended limits and satisfactory. Cable current load survey has been conducted during the audit in order to ensure the optimum loading of electrical cables. During measurement of cable loading it was seen that all the cables loading are within the recommended limit and found satisfactory. Further a few circuit breakers found overloaded and heat up as in classification of NCR's.

DB REFERNCE / NAME				**DB LIGHT AND FAN**					
LOCATION				**ELECTRIC WORK SHOP**					
FEED FROM				**MDB CUTTING DEPART**					
INCOMING SIZE CABLE				**16mm 4CORE**					
INCOMING ACB				**63A TP**					
INCOMING SUPPLY VOLTAGE(V)			**3φ (400-415)**	**R-Y:**		**MEASURED LOAD CURRENT (A)**			
				Y-B:		**I_R**	**2**		
				R-B:		**I_Y**	**3**		
INCOMING SUPPLY VOLTAGE(V)			**P-N(220-240)**	**R-N:**		**I_B**	**2**		
				Y-N:		**I_N**			
				B-N:					
SR#	**ESTIMATED LOAD IN KW**			**CB RATING**	**MEASURED CURRENT (A)**	**SIZE OF WIRE**	**PHASE**	**DESCRIPTION OF THE EQUIPMENT**	**REMARKS**
	R	**Y**	**B**						
1				**32A TP**	**SPARE**			**SPARE**	
2				**20A SP**	**OK**	**2.5mm**		**WASHROOM LIGHT**	
3				**20A SP**	**OK**	**2.5mm**		**BOUNDRY LIGHT**	
4				**32A SP**	**OK**	**2.5mm**		**L / F & EMER LIGHT**	
5				**16A SP**	**SPARE**			**SPARE**	
6				**20A SP**	**SPARE**			**SPARE**	
7				**20A SP**	**SPARE**			**SPARE**	
9							**Leakage Current; 0.005 A**		**OK**

Inspection of Light Intensity by Lux Test.

The light intensity test by Lux meter is carried out, the results are tabled below which shows some NCR's in Major and Medium risk colors. It is therefore advised that corrective actions may be taken as early as possible.

S #	Location	Result in Lux	Recommended Lux
1.	HT Switchgear Room	155	**200-400**
2.	Transformer Room	330	**200-400**
3.	LT Main Panel Room	220	**200-400**
4.	Generator Room	200	**200-400**
5.	Generator Control Room	610	**500-700**
6.	Cutting Department	400	**400-700**
7.	Value Added Finishing	435	**400-700**
8.	Production Office	450	**400-600**
9.	Stitching Department	620	**500-1000**
10.	Production Line	625	**500-700**
11.	Inspection work	825	**800-1000**
12.	Canteen	480	**400-500**

Inspection by Infrared Thermography Imaging Survey.

Thermography survey is to be conducted at the organization with the help of Infrared Thermal Camera **(FLIR USA Exclusive Model E8, Image Quality is 320x240=76800 Pixels, sensitivity 0.06-250*C)**. **This model is a professional tool top of the line of Executive Series of E4, E5, E6 & E8.** This tool captures thermal images as well as digital images instantly at the same time simultaneously i.e picture in picture. Thermography is an advance technique for the preventive maintenance as it will determine the hot spot generated in the electrical system due to lose cable connection, overloading of the cable and CB's, insulation damage etc. Apart from identifying the heating zone within the electrical system this survey also shows exposed cables, looping connections, ignorance of terminal lugs, improper tapping of joints, cable twisting and cable color coding etc via digital image picture in picture of thermal image.

CLASSIFICATION OF COMPLIANCES & NC

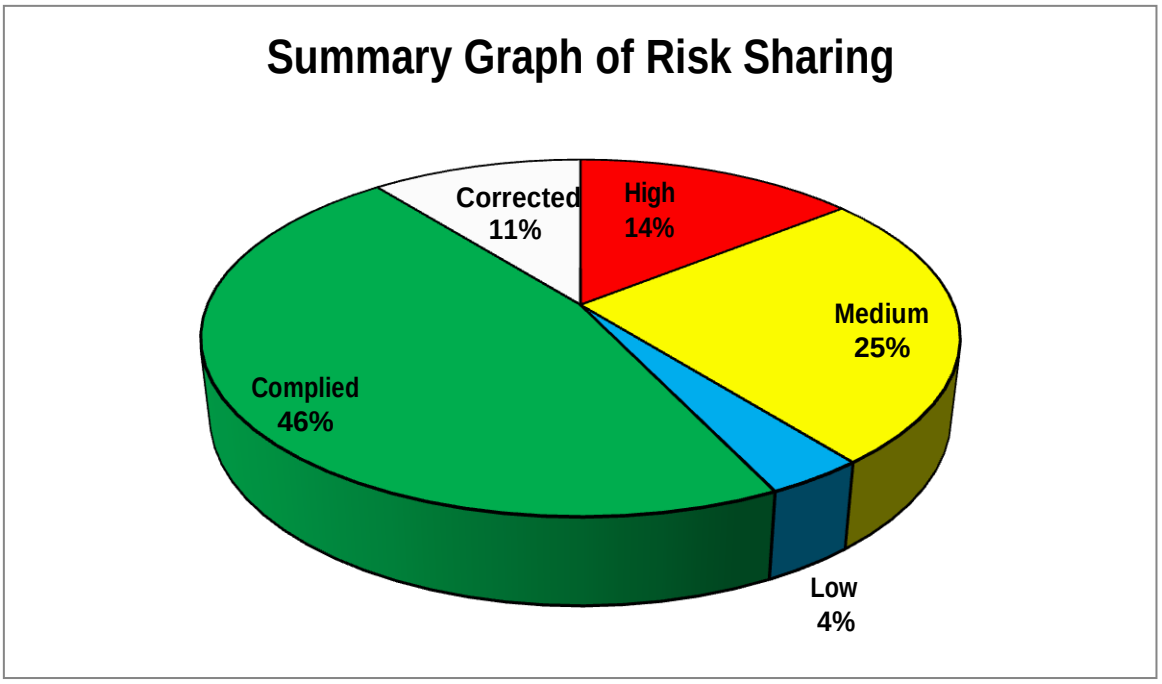
The observations made during electrical safety audit are divided into four categories based on the severity of the risks in the electrical safety point of view as High RED, Medium YELLOW and Low BLUE; whereas fourth GREEN Color category is included for good works means complied with standards finally fifth WHITE color category is created if CAR (Corrective Action Report) is received from the organization during writing a report as in the following table.

S No.	Discrepancies	Color Code For Risk
1.	SLD (Single Line Diagram) found available on record also not approved by the authority, (BS-514.9), NFPA/70E-205.2	**Major**
2.	Fitness Certificate of Transformers not found available on record, Rule-62.	**Major**
3.	Fitness Certificate of Auxiliary load of Power & Light not found available on record, (Rule-48).	**Major**
4.	Government Licensed Test Report of the total installation is not found available on record, (Rule-40).	**Major**
5.	Copies of Paid Sindh Government Treasury Challans of Inspection Fees not found on record payable under Provincial Finance Act.	**Major**
6.	Visual Walkthrough Inspection & Evidences	**Medium**
7.	MV Panels Including Protection Relay Testing	**Complied OK**
8.	RMU Including Protection Relay Testing	**Complied OK**
9.	Transformer IR Testing	**Complied OK**
10.	Cable IR Testing	**Complied OK**
11.	LBS Load Break Switch & DB's Testing	**Complied OK**
12.	Contact Resistance Testing	**Complied OK**
13.	Earth Pit Testing	**Complied OK**
14.	Hi-Pot Testing of Bus Bar	**Complied OK**
15.	Practice of safety program procedure, Training and coordination with each other and with auditors not found appropriate need some improvements	**Minor**
16.	Some Non-Compliances found in SS-II of RMU-26, Earth Result SS-I was fpunf poor which was also corrected and improved on spot.	**Corrected**

Summary of Inspection Report with Graph %age of NC's & Risks.

The percentage share of all above categories against the total numbers of observation is also demonstrated in the graphic chart below. This will help management to understand the existing level of electrical safety maintained at the organization and also to take the necessary targeted action towards improvement of electrical safety.

Grading of Risk (Overall)	No. of Observation (Overall)	% Share of Overall
High	04	14 %
Medium	07	25 %
Low	01	04 %
Complied	13	46 %
Corrected	03	11%
Total	**28**	**100%**



As above based on Summary Graph, there is RED color percentage falls in high risk NC (Non-Compliance), YELLOW color percentage is in the medium risk and whereas BLUE color percentage falls under low risk category, where as GREEN color indicates good works complied with standards respectively. Finally WHITE color category is created if CAR (Corrective Action Report) is received from the organization during writing a report. The observation falls in High risk categories requires immediate action towards corrective action and preventive system so that electrical safety is prioritized and maintained, subsequently other color percentages should be treated accordingly.

Solar System TPIValidation

Audit Assessment for Solar System installed at five locations at NBP is carried out to identify system strength based on:

- Specification & Dimensioning
- Installation
- Performance Measurement
- Warranties & Services

Audit was performed for five systems installed at:

- Main Branch NBP Nawabshah installed by M/s Solar Grid
- GT Road NBP Rawat Branch installed by M/s RERC
- North Karachi NBP Karachi installed by M/s RENU
- Main Branch NBP Thatta installed by M/s Saztel
- Main Boulevard Gulberb NBP Lahore installed by M/s Buksh Energy

Energy Efficiency Assessment of Heavy Duty Refrigeration Compressors.

A detailed Energy Efficiency Audit has been conducted at the organization's premises. The core activities performed during the audit, as outlined in the scope of work are as given below:

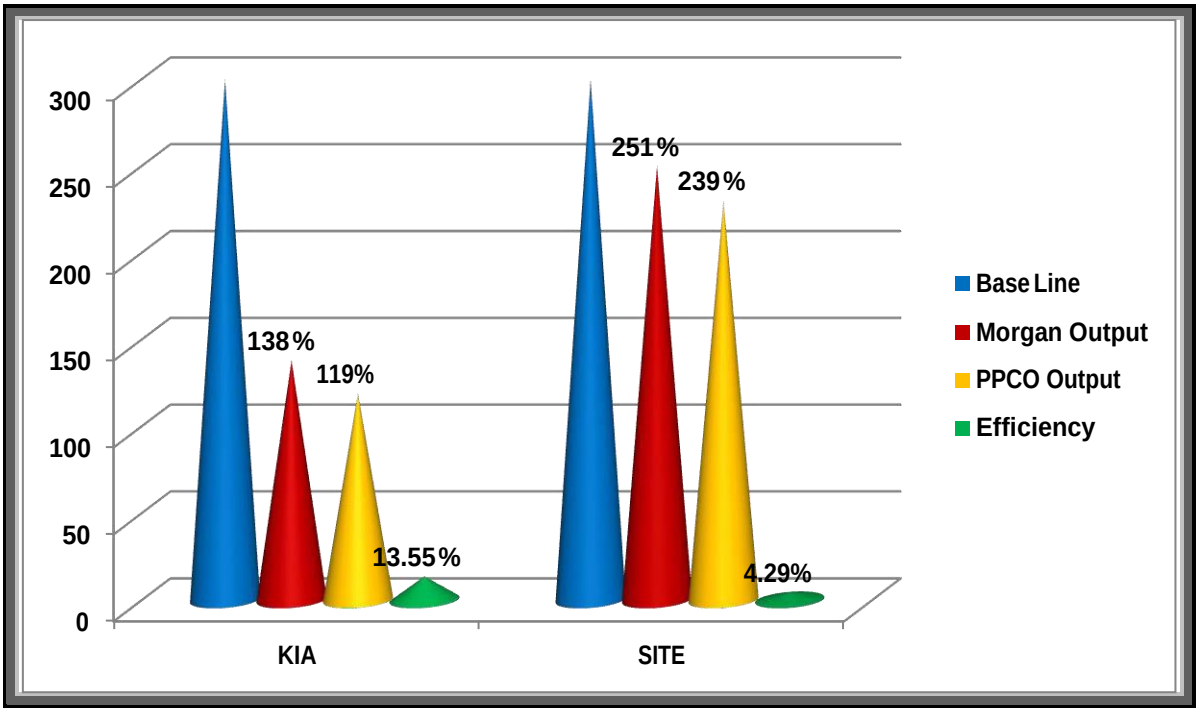
a) Assessment of compressors on energy saving.
b) Evaluation of compressors and comparison its energy consumption with local compressors which are installed alongwith the compressor.
c) Monitoring of Ampere reading of each compressor on hourly intervals.
d) Report will clearly mention the number of units (KWH) each compressor took (on hourly basis of course).
e) Monitoring and notifying following data.

Comparison of Morgan's Kirloskar Compressors and PPCO's Local Compressors				
Compressor Name	**Morgan's Kirloskar KIA**	**PPCO's Local KIA**	**Morgan's Kirloskar SITE**	**PPCO's Local SITE**
Model No.	KC6/KCX6	P.P.CO	KC6/KCX6	P.P.CO
Refrigerants Used	Ammonia	Ammonia	Ammonia	Ammonia
Tank	600	500	600	600
IL Line Current A	182	129	84.93	76.06
VLL Line Voltage V	395.3	395.3	399.5	399.5
PF Power Factor	0.99	0.99	0.99	0.99
Root-3 Constant	1.732	1.732	1.732	1.732
Real Power KW	123.36	87.44	58.18	52.10

Horse Power HP	165.36	117.21	77.99	69.84
Energy KWh in 24 Hr	2960.69	2098.51	1396.28	1250.45
Pe Kw at 35'C	117.1	Specs N/A	117.1	Specs N/A
Pe Kw at 40'C	125.8	Specs N/A	125.8	Specs N/A
Speed rpm	850	425	600	430
Blocks/24 Hr	408	250	350	300
Kwh/Block	7.26	8.39	3.99	4.17
Block/Kwh	0.13781	0.11913	0.25067	0.23991
Efficiency by Kwh/Block	13.55	%	4.29	%

Summary efficiency Audit Report with Graph % age comparison.

The percentage share of all determined by above calculations comparing efficiency of both compressors installed at two different locations i.e KIA & SITE Area, it is seen that Compressor is 13.55 % & 4.29 % more efficient than PPCO's Local Compressor respectively. The observations calculated above are also demonstrated in the graphic chart below. This will help management to understand the existing level energy consumed by both compressors. Hence the organization, if desired, can take the necessary targeted action towards improvement of energy efficiency and conservation accordingly.



Graph Chart Showing Efficiency Comparison of Both Compressors.

As above based on Summary Graph, there is **BLUE** color is a base line percentage, **RED** color is the output value line for Morgan' Kirloskar Compressors in Blocks/KWh, similarly **YELLOW** color is the output value line for PPCO' Local Compressors in Blocks/KWh, whereas **GREEN** color indicates the efficiency deference of compressors over PPCO's Local compressors. The difference of efficiency in both locations is due to many abnormal factors like supply interruption, variation in voltages, quality of motors, drums, water, salt, competency of operators, ON/OFF intervals, ignorance of ice hardness etc.

Conclusion

In the last but not the least, it that we are working in the this field since 1995, Practicing Electricity Act 1910, Electricity Rules 1937, NEPRA Laws 1997, British Standard BS-7671 and Pakistan Standards PS-3632, NFPA-70E (USA) & IEC (USA). Electrical Inspections, Testing and Audit should be done after every

year to renew its validity subject to the surveillance inspection every year. Our any report is intended to help the organization to understand the safety conditions under the prevailing system and proposed changes that will help improve the safety and reliability of the systems installed at the premises. Our report indicates the measures advised to be installed at the facility to improve safety performance, provided that the compliance is abided to the national, International standards and all local legal requirements as may be described and amended time by time.