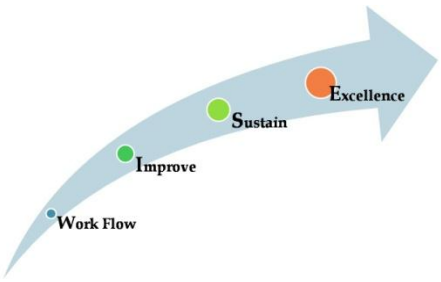
Power Quality Audit Report of ELTEX SUPER CASTINGS

Coimbatore

Power Quality Audit Done by:



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Final Report: **Friday, July 29, 2011**

Energy Audit Report of ELTEX Super Castings (Coimbatore) – Final Summary Report

Project Report Title: **Energy Audit Report**

Work Order No: **WO/MNT/2011/03 dated 26th May 2011**

Client Name: **Eltex Super Castings**

Plant Location: **ELTEX Super Castings, A Division of KLRF,**
Periyanaickenpalayam,
Coimbatore -641020

Sanctioned Demand: **1925 kVA**

Maximum Demand Reached: **1885 kVA**

Power Factor Achieved in Year 2010: **0.94 to 0.97**

Date of Report: **Friday, July 29, 2011**

Name of the Auditing Company:

WISE Management Systems,
No. 301, Sri Renga Complex,
Raja Rao Street, Tirupur – 641602
India.

Name of the Accredited Energy Auditors:

S/ N	Name of The Auditors	EM No
1	**Dr. V Rajasekaran**	**EA 9032**

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Acknowledgement:

WISE management Systems acknowledge with profound thanks and gratitude to Eltex Super Castings **Mr. Victor Vedanayagam (VP-Operations), Mr. Selvakumar, Mr. Thiruvadi Muthu, (Maintenance Team)** for their support in making this audit process viable.

Last but not least, WISE Management Systems Team comprising of Dr. Rajasekaran, Mr. Jayaraman, Mr. Saravanan, Mr. Arumugam Subramanian, Mr. Raman Azhahia Manavalan, Mr. Sivalingam and Mr. Shivashankar for their hard work and dedication in completing this assignment.

Executive Summary

This report covers the Energy Audit at the Eltex –Coimbatore; the audit measurement was conducted at all of the supply points (EB point and SSBs), Furnaces, Compressed air distribution systems at the facility.

From the analysis, identified that the Eltex Super Castings has a **good scope to improve its power quality,** and adopt **good practices in the Compressed Air distribution systems**.

WISE Management Systems Energy Audit Team recommends Eltex Super Castings Management to have an Energy Management Reviews and Technical Reviews regularly along with the Annual Follow Up Energy Audit.

S/L	Energy Saving Opportunities	Savings*	Investments*	Payback
1a	Auxiliary Transformer Tap Position Change	2,43,000	NIL	Immediately
1b	Automatic Voltage Regulator 1000 KVA	Same as 1 a	1,20,000	0.5 Years
2a	APFC Panel for MV Panel, 12 stages - 200 KVAr Capacitor Bank Enhancement- Improving Power Factor and Reducing KVA Demand	96,420	3,00,000	3.2 Years
2b	APFC Panel for GSB 2 incoming , 12 stages 200 KVAr Capacitor Bank Enhancement - Improving Power Factor and Reducing KVA Demand	73,500	3,00,000	4.0 Years

S/L	Energy Saving Opportunities	Savings*	Investments*	Payback
2c	APFC Panel for GSB 3 incoming , 12 stages 200 KVAr Capacitor Bank Enhancement- Improving Power Factor and Reducing KVA Demand	1,02,900	3,00,000	2.9 Years
3	Lighting Systems (Installation of Servo Stabilizer for GSB 2)	2,04,960	2,00,000	1 Year
4	Lighting Systems- Change to HPMV Maps and Energy efficient Copper Chocks	2,40,667	1,98,000	1 Year
5	Change to energy efficient motors for Compressors (90 KW and 75 KW)	74,250	2,00,000	2.6 Years
6	Various Continual Improvements and optimization to Compressed Air Systems	9,72,000	2,00,000	0.25 Year
7	Total	20,07,697	18,18,000	0.9 Year

* -Estimated based on rough estimates (Separate Proposal for power quality enhancement will be provided which will include BoM, materials costs, installation charges, logistics and applicable taxes)

1. Objectives of Power Quality Audit:

The following objectives of PQA (Power Quality Audit) are;

- Identify the Power Quality Issue.
- Determine the base line energy use.
- Recommend Solutions to minimize the Power Quality Issues.
- Identify the Scope for Improvement.
- Develop Action Plan.
- Assess the scope for Regular Energy Management Review & Technical Reviews.

2. List of equipment's used for the Power Quality Audit

a. Power Quality Analyzer
b. Energy Manager (2 Models)
c. Lux Meter
d. Thermal Gun
e. Clamp on Power Meter
f. Stop Watch

3. Energy Audit Team:

The ELTEX Super Castings appointed **WISE Management Systems** to carry out the **Energy Audit**. WISE Management Systems is a Management Consulting company offering Energy Management services to the industries. The details of the Energy Audit Team are given below;

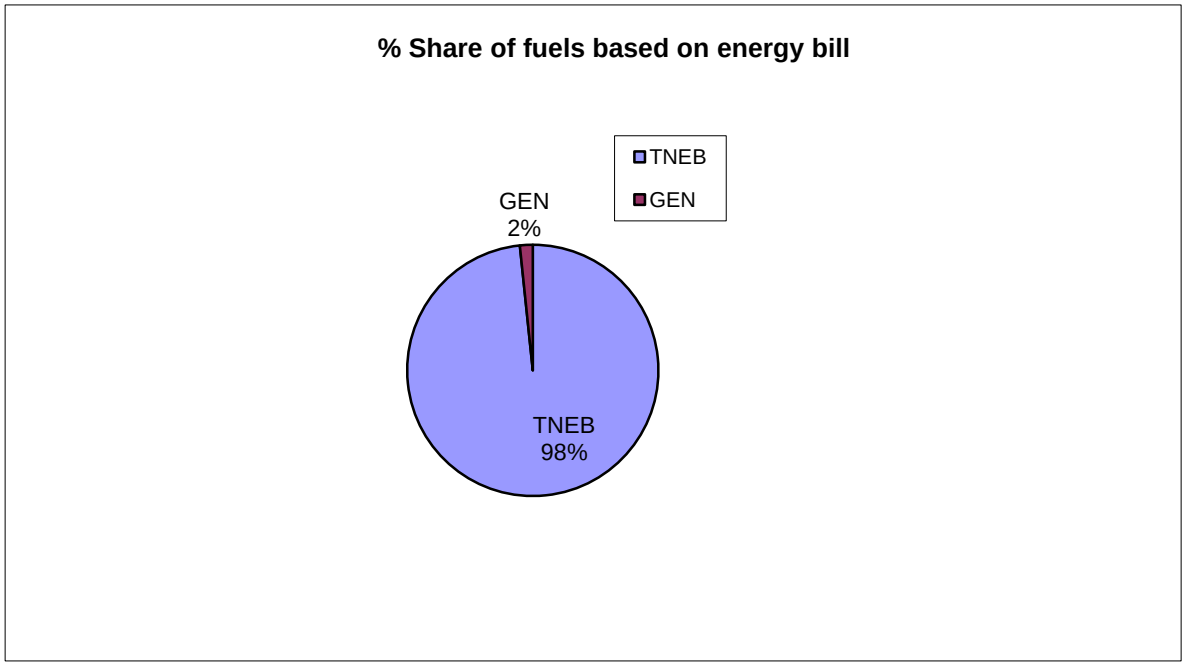
S/N	Name of the Person	Designation / EA No
1	Mr. Rajasekaran Vairamani	Energy Auditor – EA 9032
2	Mr. Jayaraman	Thermal Expert
3	Mr. Saravanan	Electrical Expert
4	Mr. Siva Lingam	Supporting Staff (Electrical)
5	Mr. Siva Shankar	Supporting Staff (Electrical)
6	Mr. Raman Azhahia Manavalan	Project Coordinator
7	Mr. Arumugam Subramanian	Project Manager

4. Baseline Power Usage:

Based on the Thermal and Electrical Energy bills for the Year 2010 (Jan-Dec), high percentile of energy is consumed from TNEB at an average cost of Rs. 5.5 and Rs. 12.00 for other part of energy is supplied by the DG sets.

The usage percentage of DG set has been selected as 2% as,

Inadequate generator capacity to cater the needs of heavy demands (if we select diesel based generators the investment cost and as well as the running cost will be very high which is not advisable)



As per the information given by the officials the factory goes down because of power cut from TNEB for 3 hours daily. This 3 hours of shut down increases the cold start period for the furnaces which minimizes the efficiency of factory i.e., SEC goes high.

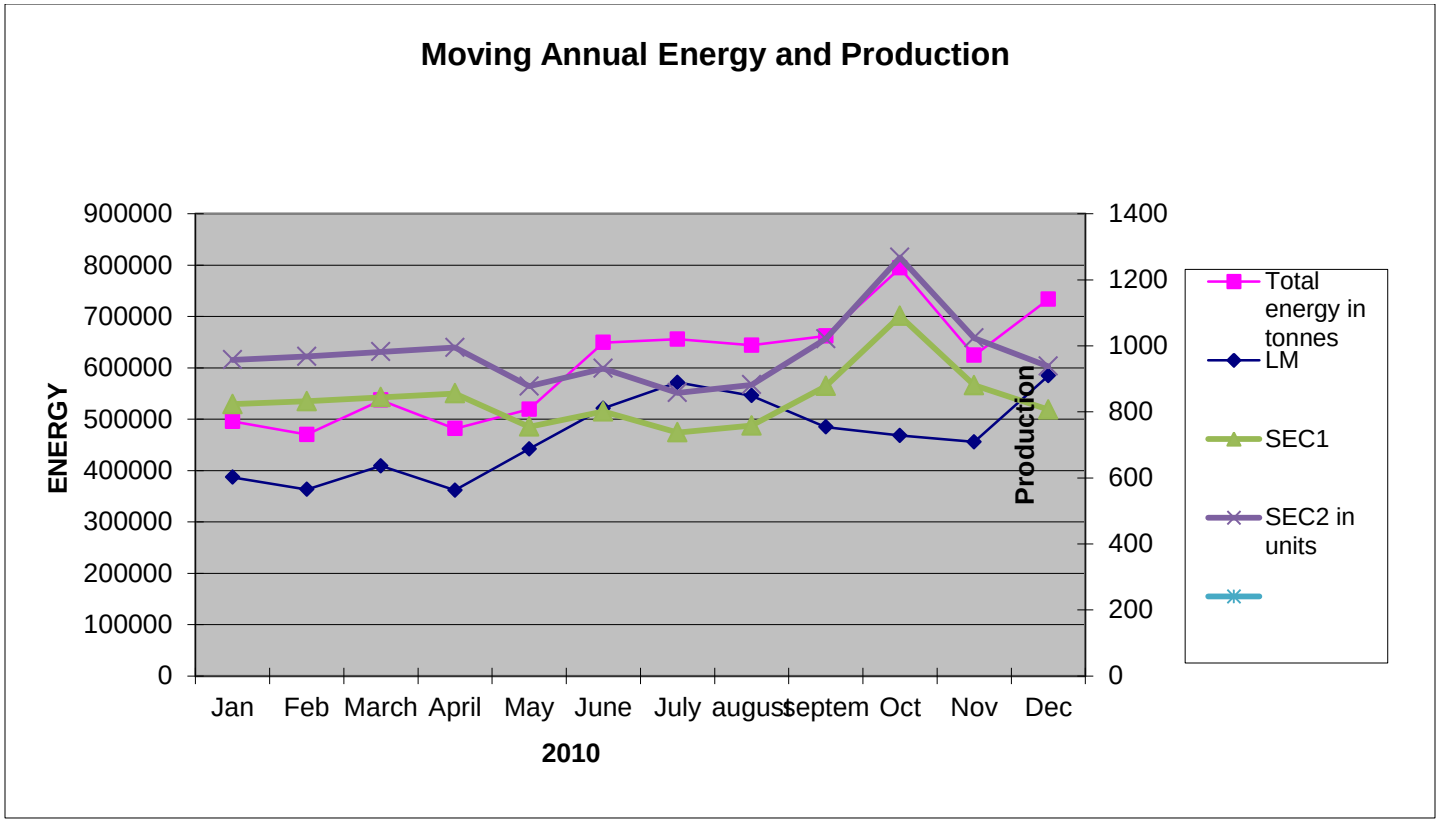
5. Baseline Performance Evaluation:

Under the Baseline assessment the audit team evaluated the **Energy consumption pattern** with respect to the production. Specific Energy Consumption is also calculated with respect to the production. (*Note: Production refers here as a number of reports generated on a particular month).*

Following analysis was done and graphical representation of the same is given here;

a) Moving Annual Energy and Production
b) Specific Energy Consumption with Production

5.1 Moving Annual Energy and Production



Based on the available data the above has been plotted. As seen in the plot, the trend is not uniform particularly from September to November 2010; energy utilized is quite high for the Liquid metal production which is low in tones.

6. Power Quality Audit Observation:

6.1 At MV Panel:

The distribution transformer of 1000 kVA, 22 kV/433 V, off load tap changing transformer caters the industrial needs other than furnaces.

The said distribution transformer supplies to the SSBs and loads through the MV Panel. The MV panel connected to the following:

1. 5 T Crane – 1 no
2. 3 T Crane – 1 no
3. GSB 1 sand plant
4. AF Accessories
5. GSB 3,
6. Cupola
7. Electrical Core, Oven
8. GSB 1- knock out,
9. SSB 2, SSB1, GSB 2
10. Melting Crane -1 no
11. GSB 1 - Cupola DB
12. M/C shop
13. LAB 1
14. LAB 2
15. Hand Moulding
16. Compressor
17. Shot Blast
18. Capacitor banks of 100 kVAr *3.

At MV panel, the following readings are observed:

kW : 332 (average)
kVA : 338 (average)
kVAr : 60
P.F : 0.96 (average)
Harmonics : nominal (V and I)
Voltage : fluctuating voltage varies from 230 V to 245 V (single phase)
Current : varies from 460 A to 580 A

Recommendation:

Even though the Power Factor is maintained at 0.96 (good), still there is a possibility to improve it further to 0.99 or Unity. At present 300 kVAr of capacitor banks are permanently connected to the MV panel, which sometimes pull down the power factor at lightly loaded conditions. We can keep 200 kVAr of capacitor banks at MV panel and another 200 kVAr can be connected to the MV panel in the form of APFC panel. This will help improve the power factor to the maximum at all the loads (most probably) and further we can get reduction in the maximum demand.

Investment and payback

Cost of the APFC panel for 200 kVAr capacitor with 12 stages : 3, 00, 000
Savings in consumption 2 to 5 % of annual consumption (including kVA reduction)
: 16070 units (@2%)
Cost of savings per annum @ Rs. 6.00 : 96420.00
Pay back period : (300000/96420)*12 = 3 years

Off-Load Tap changer can be removed with the help of on-load tap changer and it may either be selected as primary side or secondary side tap changer. The on-load tap changer is connected to the transformer as an auxiliary device and because of this we can feed power at almost constant voltage to the connected loads whatever it may be the primary input.

6.2 At EB point:

Transformer Voltage Setting: (At Auxiliary Transformer)

Observation:

Plant operating voltage plays a crucial role on energy conservation. Magnetization losses in motors vary exponentially with voltage. The TNEB High Tension voltage varies from 22.5kV to 24kV form peak hours to Off-peak hours. Majority of the time except during peak hours the plant operating voltage for the auxiliary equipment is between 430 to 450Volts on LT Side, when the 22KV/415V Auxiliary Transformer operating at Tap Position No.2.

As majority of the motors are operating below 60 to 80 % loading. At this load factor we can optimize the voltage from 430 to 400 Volts. Hence the voltage level can be brought down to 400 V to achieve energy saving.

Recommendation:

Optimize the plant operating voltage to 400 Volts by operating the 22KV/415V Auxiliary Transformer in Tap position No.1. By doing so the plant can achieve about an estimate for a voltage reduction of 3%.

Estimated Saving Potential:

The Average Auxiliary Load Consumption = 250 kW

Savings Potential by Tap Position changing = 3%

Annual Savings = Rs. 2,43,000 /- (300 Days/Yr & Unit price ` 4.50)

6.3 Readings at GSB 2

Connected loads at GSB2: 1. Lighting 2. "F" control panel 3 and 3. Cooling Tower

Observations at Lighting DB:

kW : 11 to 25

kVA : 35 to 50

kVAr : 30 to 45

P.F : varies from 0.4 to 0.6

Harmonics : nominal (V and slightly higher I)

Voltage : fluctuating voltage varies from 390 V to 395 V

Current : varies from 30 A to 40 A

Recommendations:

As far as lighting DB is concerned strictly go for a servo stabilizer of 75 kVA or 100 KVA to improve the steady voltage and to maintain the voltage at 200 V (single phase).

Investment and pay- back period

Energy consumption/year at rated voltage, say 230 V	= 25 kW *16*350
	= 140000 units
Energy consumption/year at the set voltage, 200 V	= 0.756*140000
	= 105840 units
Annual energy savings	= 140000-105840
	= 34160 units
Annual cost savings	= 34160*6.00
	= Rs. 204960.00
Investment	= Rs. 2,00,000.00 (approx.)
Payback period	= 200000/204960)*12 = **1 Year**

6.4 Readings at GSB Incoming

Observations:

kW : 35

kVA : 86

kVAr : 87

P.F : varies from 0.3 to 0.5

Harmonics : nominal

Voltage : fluctuating voltage varies from 385 V to 395 V

Current : varies from 80 A to 95 A

Recommendations:

As the power factor is very low at GSB 2, kVA demand goes very high i.e., 50 unnecessary kVA has been consumed for the consumption of less actual load.

In order to minimize the kVA demand at GSB 2, install an APFC panel for 100 kVAr with 12 stages.

Investment and pay back period

Cost of the APFC panel for 200 kVAr capacitor with 12 stages = 3,00,000

Total consumption at GSB 2 = 35*20*350

=245000 units

Savings in consumption 2 to 5 % of annual consumption (including kVA reduction)

= 12250 units (@ 5%)

Cost of savings per annum @ Rs. 6.00 = 73500.00

Pay back period = (300000/73500)*12 = **4 years**

6.5 Readings at GSB 3 Incoming

Observations:

kW : 49
kVA : 117
kVAr : 110
P.F : varies from 0.3 to 0.4
Harmonics : nominal
Voltage : fluctuating voltage varies from 385 V to 395 V
Current : varies from 110 A to 120 A

As the power factor is very low at GSB 3, kVA demand goes very high i.e., 70 unnecessary kVA has been consumed for the consumption of less actual load.

In order to minimize the kVA demand at GSB 3, install an APFC panel for 100 kVAr with 12 stages.

Investment and pay back period

Cost of the APFC panel for 200 kVAr capacitor with 12 stages = 3,00,000
Total consumption at GSB 3 = 49*20*350
= 343000 units
Savings in consumption 2 to 5 % of annual consumption (including kVA reduction)
= 17150 units (@ 5%)
Cost of savings per annum @ Rs. 6.00 = 1, 02900.00
Pay back period = (300000/102900)*12 = **2.9 year**

6.6 Energy Savings in Lighting Systems

Observation: 1. (Scope to replace 400 Watts HPMV Lamp with 250 Watts MHL)

Eltex Plant already installed Energy Efficient Metal Halide Lamps in few locations of Foundry area. There is a further scope to reduce the energy consumption in the Shop Floor area by replacing the 400Watts High Pressure Mercury Vapor lamp with Energy Efficient 250Watts Metal Halide lamp.

Recommendation:

For equivalent light output, replace existing 400Watts HPMV lamp with 250Watts Metal Halide lamp & 250Watts HPMV Lamp with 150Watt Metal Halide Lamp. The luminous Efficacy of High Pressure Mercury Vapour Lamp & Metal Halide lamps are as follows:

Sl. No	Type of Lamp	Luminous Efficacy	Lumen Output	Saving in Watts
1	400Watts HPMV lamp	55 Lumens/Watt	22000Lumens	-
2	250Watts Metal Halide lamp	90 Lumens/Watt	22500Lumens	150Watts

Estimated Saving Potential:

Luminous Efficiency of HPMV Lamp = 55Lumens / Watt

Luminous Efficiency of Metal Halide Lamp = 90 Lumens / Watt

No of HPMV Lamps Used is 32Nos. replacing with the Metal Halide lamps of 32 Nos

Energy Savings = 150 Watts X 32 = 4800 Watts = 4.8 KW

Annual Savings = Rs.77760/- (300 Days/Yr & Unit price Rs. 4.50)

Investment = Rs 80,000 /- (Rs. 2500/- per fitting (for Lamp & Choke alone))

Payback = 12 Months

Observation: 2 (Optimizing voltage by installing Lighting Voltage stabilizers)

At present, majority of lighting feeder is operating voltage varies from 242 to 260Volts. A good potential exists to save energy by optimizing voltage by installing Lighting Voltage stabilizers.

Recommendation:

The voltage reduction can be achieved by installing a servo voltage stabilizer. We recommend installing 50KVA voltage stabilizer for the main lighting feeder and operated the lighting circuit at 210 Volts. The optimum voltage for Lighting circuit is 205Volts and 5Volts for cable drop. Installation of Servo Voltage Stabilizers for Lighting Feeders not only saves the energy, it also saves the life of the lamps and other equipment.

Estimated Savings Potential:

Saving Potential is 15%

Average Lighting load = 25KW (During Daytime)

= 35KW (During Night Time)

= 30KW (Average)

Saving in KW due to reduced voltage operation = 4.5 KW

Annual savings = Rs.1,45,800/- (300 Days/Yr & Unit price Rs. 4.50)

Investment for 50KVA Stabilizer = Rs.1,00,000/-

Pay Back in 8 Months

Observation: 3 (Replacing Conventional Choke with Energy Efficient Chokes)

Presently 60Nos. of fluorescent lamps are in operation continuously in Eltex. Conventional chokes consume power for inherent iron losses and copper losses. The conventional choke consumes 10 to 14Watts for its inherent losses. The Energy Efficient Copper Choke consumes only 4 to 5Watts, because of it better core construction materials, Vacuum Impregnation techniques and more copper areas to reduce losses.

The comparison of power consumption for conventional choke and the energy efficient electronic choke is given below:

Power Consumption	Conventional Choke	Energy Efficient Copper Choke
Tube light	50 – 54 Watts	44 – 45 Watts
Loss	10 – 14 Watts	4 – 5 Watts
Saving in Watts		6 – 10 Watts

Recommendation:

The conventional choke used in the Tube light fitting can be replaced with energy efficient copper choke to minimize lighting power consumption.

Savings Potential:

Savings potential per tube light fitting is 6Watts

Saving Potential for 60 no of Tube Lights = 360Watts

Annual Energy Savings = Rs.17107/- (330 Days/Yr & Unit price Rs. 4.50)

Investment for 60Nos. of Choke= Rs.300 X 60 = Rs.18000/-

Payback period = 12.7 Months

6.7 Energy Savings in Motors

Observation: (Replacing Inefficient Motors with Energy Efficient Motors)

The Surface Temperature profiles were measured to the motor to evaluate its efficiency. The normal surface temperature of the motor will be around 50 to 60 Deg C. But the old 90KW Compressor motor surface temperature is abnormal and more than 75 Deg C.

Recommendation:

We recommend replacing the motor with 90KW Compressor Energy Efficient motors. The expected minimum saving potential is 5% of the actual power consumption.

Saving Potential:

Actual Power consumption of 90KW Compressor is 75KW. The savings potential is 5% of the actual power consumption. Savings Potential is 3.75KW

Annual savings = 3.75KW X 4400Hrs/Year X Rs.4.50/Unit

= Rs.74,250/-

Investment = Rs.2,00,000/-

Payback = 32.43 months

6.8 Minimizing Compressed Air Leakage

Observation: 1 Air Leaks

Presently 2 Numbers (75 KW & 60 KW) of compressors are used to generate compressed air for the plant normal operation. The newer LG make 75KW compressor is of 526 CFM capacity and the older 60KW compressor is of 350 CFM capacity. The older and less efficient 350 CFM compressor is being run continuously (with 7 Kg/cm2 set pressure) as a base compressor and the newer more efficient compressor is being used as trim compressor running in load-unload with 6.3 cut-in & 6.9 bar cut-out setting.

Compressed Air leak detection survey was conducted during the lunch time, when majority of the equipment using compressed air are switched-off. Majority of the air feeding valve produce "Hissing" sound due to air leakage. Some of the identified places of air leakages are as follows:

- Shot blasting machine
- Hydraulic cutter
- Pneumatic tools pipe joints
- Compactor Machine No.1- Air inlet line
- Mould drilling machine air line
- ARPA 900 Air line
- ARPA 300 Airlines

We estimate that, there is a scope to minimize of up to 30KW power saving will be achieved by minimizing the compressed air leakage.

The 526 CFM compressor runs in unloaded mode for nearly 50% of the time. During the unloaded condition the compressor uses almost 50% of the full load power without delivering air. The >50% current for unloaded operation indicates the wasted power quantity of > 50%.

Observation: 2 Scope to reduce Air Pressure

Considerable quantity of compressed air at 6.5 bar pressure is being used for cleaning operation in the mold making process. Compressed air at **3 bar** pressure will be adequate for the cleaning operations. Such lower pressure air use will also have lesser leakage losses.

An experimental optimization exercise carried out indicated that there is a potential to reduce air compressor Cut-In/Cut-Out pressure settings by about 0.7 bar and the pressure control variation band from 0.6 bar to 0.4 bar without affecting the processes.

Setting Trial	*Cut-In Setting*	*Cut-Out Setting*	*Reservoir Pressure*	*Load Current*	*Unload Current*
Initial	*6.3 bar*	*6.9 bar*	*6.4 bar*	*135 Amps*	*75 Amps*
Final	*5.7 bar*	*6.2 bar*	*6.0 bar*	*130 Amps*	*71 Amps*

With the above slight change in pressure setting saving potential is about 41 kW.

Observation 3: (Use of Electrical Grinders instead of Pneumatic Grinders)

The Pneumatic grinders should be replaced with Electric grinders with flexible shafts. This would reduce the power consumption of the grinders to less than 15% of the power required to produce compressed air for doing the same grinding function. Use of Electric grinders with flexible shafts will reduce the load on the compressor demand for high pressure air.

Recommendation:

a) Replace the old ball valves in compressed air line with a new one.

b) Coupling points of air hoses with the valves.

c) Conduct a system efficiency test every month and keep the leakage levels below 10%.

d) Isolating the cleaning air demand to a low pressure (3 Kg/cm2) and lesser CFM compressor attached to a separate storage of sufficient volume capacity (say1000 lit) can considerably reduce power consumption and save significant compressor electrical power costs.

e) Evaluating the performance of Air Dryer/Moisture remover to minimize the pipe & valve corrosion and erosion.

f) Reducing the inlet air temperature by locating the air suction point outside the compressor room area having lower ambient temperature and also by improving inter-cooler operation would improve the volumetric efficiency of the compressors.

g) The mold making machineries can work comfortably at 5.5 bar as minimum pressure. Therefore reduce the Upper and Lower threshold pressure settings of the Trim Compressor to 6.2 bar and 5.7 bar respectively

h) Create an awareness program by displaying posters: e.g. 1/8" hole at 7 Kg/cm^2 can lose annually Rs. 50,000/-

Saving Potential: For Recommendation 1

Energy Savings = 30 KW

Annual Savings = Rs. 9,72,000 /-

6.9 Energy Saving Opportunities in Induction Furnace Systems

Baseline Observation:

Two Electric Induction melting furnaces one 3.5 Tonne and another of 1.5 Tonne capacity are being used. The 3.5 Tonne capacity furnace of BEMEC, Mysore makes use 50 Hz fixed line frequency and is rated for 700 KW power.

The actual power at which it is operated is in the range of 450 to 500 KW depending on the available power in the supply. The input power variation in this furnace can be effected by selectable step changes in input voltages. The 1.5 Tonne capacity furnace of BEMEC, Mysore make uses 350 Hz frequency and 1000 KW power. The input power variation in this furnace is effected by a Variable Frequency drive system with input voltage being kept constant.

The 1.5 Tonne capacity furnace requires only 800 KWH while the 3.5 Tonne capacity furnace requires only 850 KWH for melting one Tonne of steel. A Power Distribution Optimizer System supplied by a third party is used to divert maximize power input to the more efficient 1.5 Tonne furnace and supply the balance power available to the less efficient 3.5 Tonne furnace.

The optimizer pumps up to 1160 KW (16% more) power to the 1.5 ton capacity furnace as compared to its rated value of 1000 KW. This is done to increase production and overall efficiency of the Induction melting facility.

Melting Temperature in the furnace crucible is observed to be varying between 1550 to 1600 Deg C. The melt heating time for 1 Tonne of iron in the 1.5 Tonne crucible varies between 45 to 65 min depending on the power input. The melt heating time for 2 ton of iron in the 3.5 ton crucible varies between 120 to 180 min depending on the power input. The molten metal of one Tonne is transferred to a 1 Tonne capacity ladle for magnesium treatment where the temperature drops by 50 to 70 Deg C. Melt Transfer from crucible and Magnesium treatment in the 1 ton ladle take about 1 minute.

The treated 1 ton metal is then poured into four smaller 250 kg capacity ladles in which a small quantity of Ferro-silicate is added. This operation takes nearly 1 minute duration. The temperature drops observed during this operation was about 30 to 50 Deg C. The four 250 kg ladles are taken to their respective pouring locations, their required temperature (1430 max) confirmed and pouring into molds started within about 30 seconds duration. The temperature drop observed during this period is observed as about 25 to 50 Deg C. The operation of pouring into the line of molds is completed in about 4.5 minute's duration. The temperature drop during this period is observed as about 35 to 50 Deg C. The minimum temperature required at the last pouring is 1380 Deg C.

All operations from start transfer of molten metal from crucible to 1 ton ladle to completion of the pouring in the mold line are being completed within 7 minutes duration. Considerable thermal energy in the form of heat of hot fumes/flames and radiated heat from the molten metal (at 1500 to 1600 Dec C) is now being let into melting area atmosphere and being wasted as no effective heat recovery system is available. The method of slag removal from the molten metal is not an elegant one and requires improved arrangement. The one time contact method of temperature measurement using consumable /disposable temperature sensor is not very accurate, convenient and cost effective to use.

Observation 1:

During the Energy Audit it has been identified that about 50 kg of excess metal was left unused in each of the 250 kg after pouring into the molds and the total 200 kg metal was taken back into the 1 Ton ladle for transferring to the crucible for reheating.

While the 1 ton ladle is having a load sensor and display the 250 kg ladles do not have load sensor and display resulting in excess metal being taken resulting in thermal wastages.

Observation 2:

Travel of the cradle along the 90 Deg turning overhead rails is not smooth. It was observed that the operator has to overcome considerable resistance for manual pushing of the ladle in this area.

Observation 3:

The walk area along which the ladle travel is done by manual pushing by the pouring operators is cluttered with materials and loose sand offering some difficulties for the smooth and quick ladle travel.

Recommendations:

a) Replace the Old 3.5 ton crucible fixed frequency 50 Hz Induction furnace system with a latest higher and variable frequency induction system of 1.5 ton capacity will save more than 50KW of power per Ton of metal melted now using the old furnace.

b) All the four 250 kg ladles to be provided with load sensors to know exactly the weight of metal poured into them. This provision can avoid taking extra metal that will go unused resulting in wastage of thermal energy.

c) 1 ton ladle and the 250 kg ladles should be provided with overhead non-contact temperature sensors to continually monitor the exact values and precisely

control the process duration. This provision can optimize the crucible heating time and control the melt temperature not to exceed 1550 Deg C. The 50 Deg C reductions in heating and the optimized heating duration will save considerable Thermal energy and Electrical Power/Cost.

d) An effective system can be designed to recover the heat from the hot fumes/flames and from radiation of the molten metal without affecting/interfering the operations of solid metal charging to and molten metal removal from the crucible by tilting.

e) The recovered heat can be effectively reused by ducting it to the Core Baking Oven to save 54 Kw of electric power being used for the core baking at about 170 to 180 deg C.

f) Improvement or maintenance of the 90 deg angular turning overhead rails area for smooth, resistance free and quick travel of the ladles is recommended.

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7. Power Quality Audit Observation Recommendations Tracking Sheet:

S/N	Energy Saving Opportunity	Recommendation	Responsibility	Target	Remarks
1	Transformer Voltage Setting	a) Optimize the plant operating voltage to 400 Volts by operating the 22KV/415V Auxiliary Transformer in Tap position No.1. **b)** Automatic voltage regulator 1000 kva (controller) to optimize voltage settings			
2	APFC @ MV Panel	Install 200 kVAr of capacitor banks at MV panel and another 200 kVAr can be connected to the MV panel in the form of APFC panel.			
3	Servo Stabilizer for Lighting Load at Lighting DB's	Servo stabilizer of 75 kVA or 100 KVA to improve the steady voltage and to maintain the voltage at 200 V (single phase). **Refer 6.3**			
4	Improving Power Factor at GSB 2 Incoming	To minimize the kVA demand at GSB 2, install an APFC panel for 100 kVAr with 12 stages **Refer 6.4**			
5	Improving Power Factor at GSB 3 Incoming	Minimize the kVA demand at GSB 3, install an APFC panel for 100 kVAr with 12 stages **Refer 6.5**			
6	Energy Savings in Lighting Systems	Replace existing 400Watts HPMV lamp with 250Watts Metal Halide lamp & 250Watts HPMV Lamp with 150Watt Metal Halide Lamp.			
7	Energy Savings in Lighting Systems	Installing 50KVA voltage stabilizer for the main lighting feeder and operated the lighting circuit at 200/210 Volts. The optimum voltage for Lighting circuit is 205Volts and 5Volts for cable drop.			

S/N	Energy Saving Opportunity	Recommendation	Responsibility	Target	Remarks
8	Energy Savings in Lighting Systems -	Replace conventional choke used in the Tube light fitting with energy efficient copper choke			
9	Energy Savings in Motors	Replace the motor with 90KW Compressor Energy Efficient motors			
10	Minimizing Compressed Air Leakage	a) Replace the old ball valves in compressed air line with a new one. b) Coupling points of air hoses with the valves. c) Conduct a system efficiency test every month and keep the leakage levels below 10%. d) Isolate cleaning air demand to a low pressure (3 Kg/cm2) and less CFM compressor, attach separate storage of sufficient volume capacity e) Evaluate Air Dryer/Moisture remover to minimize pipe & valve corrosion and erosion. f) Reduce inlet air temperature by locating the air suction point outside the compressor room area having lower ambient temperature g) Reduce the Upper and Lower pressure settings of Trim Compressor to 6.2 bar and 5.7 bar h) Create an awareness program by displaying posters:			

S/N	Energy Saving Opportunity	Recommendation	Responsibility	Target	Remarks
11	Punematic Grinders	Replace Electrical Grinder for Compressed Air Grinder			
12	Electric Induction Furnace	a) Replace Old 3.5 ton crucible fixed frequency 50 Hz Induction furnace system with a latest higher and variable frequency induction system of 1.5 ton capacity b) Provide load sensors to all four 250 kg ladles . c) 1 ton ladle and the 250 kg ladles should be provided with overhead non-contact temperature sensors to continually monitor the exact values and precisely control the process duration. d) An effective system can be designed to recover the heat from the hot fumes/flames and from radiation of the molten metal - recovered heat can be effectively reused by ducting it to the Core Baking Oven to save 54 Kw of electric power being used for the core baking e) Improvement or maintenance of the 90 deg angular turning overhead rails area for smooth, resistance free and quick travel of the ladles			

8. Certification

I. The data collection has been carried out diligently and truthfully.

II. All data monitoring devices are in good working condition and have been calibrated or certified by approved agencies authorized and no tampering of such devices occurred.

III. All reasonable professional skill care and diligence had been taken in preparing the energy audit report and the contents thereof are a true representation of the facts.

IV. The energy audit has been carried out in accordance with the bureau of Energy Efficiency Regulations 2010.

V. WISE Management Systems Team is committed to take over this step further and assist your team to implement the recommendations given.

(V. Rajasekaran) EA – 9032

Energy Advisor – WISE Management Systems