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Effective Cost Reduction Techniques in Chemical Industry

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ABSTRACT

Energy saving is the controversy one. The main of doing this work is cost reduction of production. This can be effectively done by reducing the power Consumption. For this, the best suitable method is by diverting prime power from motor to turbine. This is done by utilization of surplus steam obtained from the Sulphuric acid plant. Since all the reactions in the Sulphuric acid plants are exothermic, a large amount of heat is generated and this is used for generating steam which is used to drive the turbine. This project aims to couple turbine with DH fan which is currently driven by 600kw motor, thus to save a huge amount of electric charges and then by reducing cost. Since steam is available in company at free cost, this method can be chosen as one of the best methods for reduction of cost of production.

Key words: Energy saving, Sulphuric acid plant, Motor and Turbine

INTRODUCTION

Energy is the primary and most universal measures of all kinds of work by human beings and nature. The conventional sources of energy are depleting and may exhaust by the end of the century or beginning of the next century. The supply of oil will fail to most increasing demand before the year 2050.Due to this reason energy conservation techniques are becoming important. Under industrial conditions there are after several tasks which require energy, but which lie at different gradient levels. It makes use the waste heat from one process to serve the need of another.

COMPONENTS AND FABRICATION METHOD

Kunhle Kopp Kousher Steam Turbine

The KKK (Kunhle Kopp Kousher) turbine is a single stage, two rim action turbine. Turbine and gear of this form one unit. After leaving the nozzle ring, the steam flows through the first blade rim of wheel, is reversed in reversing blade and then led through the second blade rim. It is equipped with hydraulic trip device which automatically cut of steam supply the turbine whenever maximum admissible speed is attained. The turbine shaft rotates in ball bearing lubricated by splash oil. Cooling is provided by a cooling coil incorporated in to the bearing casing in such a way that temperature is maintained. A single stage gear is equipped with a single helical too thing.

Table-1 Operation Condition (KKK Steam turbine)

S. No.	Specification	Operation condition	Quantity
1	Output	Normal Maximum	387kw 414kw
2	Turbine speed	Normal	8400/ min
3	Secondary speed	Normal	5290 / min
4	Live steam pressure	Minimum Normal Maximum	310 330 340
5	Exhaust steam pressure	Minimum Maximum	1.175 bar 1.96bar

Gear Box

The gear box shall be rated for the turbine rating of 414kw.Gearbox shall be parallel shaft, helical type. It shall be provided with separate thrust bearing. The gear box shall be designed to run safely to the tripping speed setting of drive steam turbine. Gear box shall be suitable for mounting bolts should be provided. The environment around gearbox is corrosive. Hence the material of construction should be suitable for this. Gear box shall have suitable oil contained lubrication system. Cooling water supply pressure is 4kg/cm^2.Noise level shall not exceed 90db at one meter from the equipment. High speed coupling and low speed coupling shall be supplied by gear vendor. Coupling shall be gear type with spacer.

De Humidifying Fan

The purpose of dehumidifying fan is to deliver dehumidified air to the factomfos storage area. It consists of rotor, casing, suction vanes, suction filter etc…It is a centrifugal type fan which has a capacity of drawing 170000m^3/hr of ambient air which is presently driven by a 597Kw (800- HP) 3 phase induction motor. The purpose of the project is to replace the above motor with a steam turbine.

FABRICATION DETAILS

Carefully align the shaft of the turbine and working machine with water balance and aligning device. Line all the points of support only with smooth metal shims; avoid distortion, particularly of the gear casing, when tightening of foundation bolts. Duly consider the change of axle level which maybe results of unequal heating of the coupled machine under operation and standstill condition.

Level difference can be computed as:

$$H=1.2*H_t^{Tt}- 1.2*H_a^{It}$$

Where

H= level difference in cold condition, mm.

H_t=Axle level of turbine, mm

H_a=Axle level of working machine, mm.

T_t=Temperature difference between turbine bearing casing and its surrounding ,^{o}C.

T_a=Temperature difference between working machine and surrounding ,^{o}C.

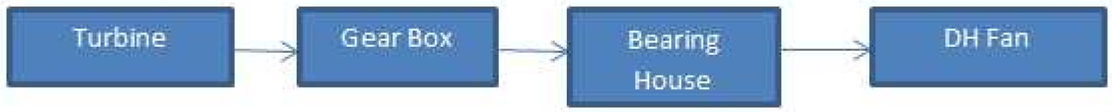

Fig.1 Line Diagram of Fabrication Details

RESULTS AND DISCUSSION

Table-2 Equipment Details

DETAILS	STEAM TURBINE	DH FAN
Make	KKK turbine	Robinson
Type	Geared	Horizontal, radial
Model	CF4G	-
Rated HP	414kw	588kw
Rated speed	5810	-
Extension	100mm	8inch
Diameterof shaft	60mm	4.935
Diameter of shaftwith key	64.3mm	Hold
CL elevationTurbine shaft	500mm from turbine support	460mm
Direction of shaft rotation	CW when viewed from non-drive end	CW when viewed from drive end

DH Fan Operating Conditions

Fluid handled-ambient air, Capacity-170000m^3/hr., Inlet pressure-13WG, Outlet pressure-830WG

Calculation Motor Cost

Power- 597kw, Speed- 1450rpm, Efficiency of motor- 70%, Number of days- 300days

Number of hour per day- 24hrs, Unit charge- Rs 4.20

Q=Power*no of days*no of hours*unit charge*efficiency=597*365*24*4.20*.70

Q =153 lakhs

<u>Turbine Cost (Single Stage Turbine)</u>

Power-414kw, Efficiency of turbine-80%, Number of days-300, Number of hours per day-24, Unit charge-4.20

Q=power*no of days*no of hours*unit charge*efficiency =414*365*24*4.20*.80

Q=121 lakh

Motor cost-turbine cost =153- 121=32lakhs

<u>Initial Cost Analysis</u>

Gear Box -13 lakhs, Foundation, supports & other civil jobs-4lakhs

Base plate, suction filler, pipe, and pipe fitting & piping erection-5 lakhs

Insulation-0.7lakhs

Total =22.7 lakhs=32-22.7=9.3 lakhs

<u>5 years</u>

Motor Cost,153*5=765lakhs ;Turbine Cost,32*5=160lakhs

Motor cost-turbine cost =765-160=605 lakhs

CONCLUSION

The aim of the work is to utilize the excess steam and thus to save a large amount of electricity there by reducing the production cost in the NPK plant, FACT Cochin division, Ambalamedu. Even though the initial cost is moderate, the money spend on the project would be regained within two months of successful plant running. About 32lakhs of rupees can be saved every year by the implementation of this work. Thus we may proudly say that our work was a successful one.

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