

Non Implemented Case Study– Energy Conservation Measure

Measure
Use of soft starter in motors operating at varying load
Equipment
Presses
Industry / Sector
Home appliance
Year of Implementation
Not implemented
Cost Benefit Analysis
⦿ Type of Measure: Long term
⦿ Annual Energy Savings: 7500 kWh
⦿ Actual cost savings: Rs.0.35 lakh
⦿ Actual investment : Rs.1.50 lakh
⦿ Payback: 4.28 years
Implementation Highlights
<ul style="list-style-type: none"> ☞ Very simple measure and can be easily retrofitted ☞ Results in smooth start of the equipment and is very effective in case of large motors where the motors switched on & off very frequently, to keep the demand under control ☞ Plant has accepted the proposal to implement when plant goes for three-shift operation. ☞ Plant has not implemented due to <ul style="list-style-type: none"> ⦿ Less operating hours of the equipment ⦿ High investment ⦿ Long payback period

Summary

Retrofitting the soft starters in motor results in providing the smooth acceleration of the motor and coupled load. The energy savings ranges from 3-15% depending up on the application and variation in load.

Background

Leading home appliances company has many mechanical presses for drawing and deep drawing of the sheets. The electrical loading of the press was monitored for a variety of raw materials at varied thickness. The salient features of the press operation was

- ☉ The power consumption during the one press cycle varied in the range 15-90% of the rated motor capacity (30 kW).
- ☉ The power consumption is also varied from thickness to thickness (higher the thickness more power is consumed).
- ☉ The press is operated for variety of thickness.
- ☉ The power factor is varied in the range 0.30 – 0.78.

Proposal:

In view of varying load and varying power factor it was suggested that soft starters could be installed to improve the power factor during entire cycle of the operation and to have smooth operating.

During the study, the manufacturer of such equipment was called and asked to demonstrate the product. During demonstration trial it was ensured that the press was operated for same thickness of the product for both cases.

The results of the demonstration trial are:

Before installation of soft starter

Power consumption for one hour : 18 kWh
Power factor : 0.30-0.87

After installation of soft starter

Power consumption for one hour : 16.5 kWh
Power factor : 0.90
Energy savings : 1.5 kW
Percentage savings : 8%

Techno-economics:

Power savings : 1.5 kW
Operating hours : 5000 h
Annual energy savings : 7500 kWh
Annual cost savings (@ Rs.4.7 per kW) : Rs. 0.35 lakh
Investment required : Rs 1.50 lakh
Payback period : 4.29 years

Principle

Starting has been a perennial problem with induction motors. The starting current is high resulting in jerk start and associated problems with shafts, gears, belts and so on. This problem has been alleviated to limited extent by using star /delta starter or auto transformer. Soft starter which have entered the market have been helpful in solving some of these problems apart from saving electrical energy.

Soft starters apply a gradually increasing voltage to the motors resulting in smooth acceleration of the motor and coupled load. It provides a linear power ramp for smooth stepless acceleration, which reduces inrush currents and excessive wear on mechanical driven components. The starter has a provision to adjust the starting voltage and acceleration time. This can be chosen to suit specific application.

Advantages of soft starters over conventional starters

- ☺ Reduction in starting current
- ☺ Improved power factor at all load cycles and there by reduction in kVA demand and distribution losses
- ☺ Reduced power surge
- ☺ Reduced heating of the motors and improves operating efficiency
- ☺ Possibility of increased number of starts per hour
- ☺ Increased contact life of starter contractors
- ☺ Adjustable acceleration time
- ☺ Elimination of starting mechanical shock to couplings and driven equipment

The electronic ballast or choke (solid state choke) does not require starters or capacitors to be used with it. It consumes only 7 W when compared to 15 W of power in conventional choke. More over the efficiency of the lighting improves by 10%. The power factor is improved.

The electronic choke offers a rapid start to the system, which lights in less than one second. Stroboscopic effect, other wise known as flickering effect is more pronounced in conventional choke which are operated at the mains frequency.

The life of the tube is also increases as compared to a tube used with conventional choke.