

## Over Motoring – A Boon to the Textile Industry ?

### Introduction: -

Generally speaking, motor, the workhorse of the industry is a device used to convert Electrical Energy to Mechanical Power, but the motor consumes power during the conversion. **Here we observe, cooler the motor, it converts more to load, and consumes less.** Also, we find the case study in the industry; two motors can have same full load efficiency as per the name plate, but operate at appreciably different low & high efficiencies near to operating load level. Considering the above facts, industry is exploring the **over motoring as one of the options to their high load factor motors to sustain Energy Efficiency.**

- **Let us take a typical case study of high load factor motor, i.e. the 24 hour run 360 day motor running in textile spinning mill segment. The mills find this over motoring exercise as a compromising alternative to suit the existing ambient & load conditions. These types of similar examples do happen in the other industry segments as well. This ring frame is the typical Cash cow for the textile industry. Hence the mills are implementing various options to milk the cash cow to get the best possible optimum & sustained Efficiency. So this over motoring is also a viable alternative, the other industry segments can think of this option also, as one of factors to improve their energy efficiency in motor loading.**
- The motor OEM says that their EE motors have flattish peak efficiency between 55 to 95 %. This flat curve starting from 55 and ending at 95 % peaks smoothly around 75 %. But this application at ring frame calls for rigorous, continuous, sustained, cyclic and harsh conditions in and out of the ring frame motor and makes the motor to de-rate by 10 to 15 % very shortly. That implies that the flat efficiency curve starts early at around 40 % loading and ends at around 80 % .Hence here comes the need for over motoring. Still this is okay, because all the mill users are prepared now to spend higher First Cost to get a Lower Running power cost per motor in the ring frame application. **These conditions have only prompted the motor OEMs now and they are recommending their super EE motors at 50 - 60 % loading level, even for conducting trial in the textile mills.**
- **International copper promotion council have stated that “56 no. 34 kW ring frame motors replaced with 45 kW motors to gain 7000 Kgs additional production per year through increased machine speed This would give payback investment in 6 months. Specific energy consumption has gone up by 7.5% but the increased output of the process derived a gain of 4.5% higher fetching 2 time’s higher revenue”. They have put up many case studies regarding EE motors and in one of their case studies in Indian textile mills state that Ring Frame motor application in a textile spinning mill.**
- **Here is a typical case study of over motoring that is an oversized motor operating at under load, runs cooler. One mill is putting a 55 KW motor on a 37 KW motor frame to drive 1008 spindles; where in the average motor consumption is only 30 units per hour only during the Doff cycle. Another mill is putting 75 KW motor on a 55 KW motor frame to drive 1200 spindles, where in the average motor consumption is only 36 units per hour only during the Doff cycle. After effecting the change, the mills now consume less units per Kg of yarn for the given spindle speed & later, they can ramp up the spindle speed economically too.**
- Long ago, the mills operated Short ring frames with 500 spindles with 15 KW motor, later they doubled to Long ring frame to 1000 spindles and operated the frame with motor of 34 KW. Now the mills are finding the Long Ring frames are better working at sustained loading level of 50 % after changing their motors from 34 KW to 45 KW. By this, they are able to increase the spindle speed, increase the spindle utilization, increase the spindles load as well. **Now the mills are contemplating to try around 1500 spindles with 75 KW motor.**
- Now we understand that the mills, **long before designed for 30 watts per spindle in ring frame, and the same ratio has increased to 40 watts per spindle recently and now the present ratio is 50 watt per spindle in ring frame.** They are able to treble the spindle load now in the long frame compared to the short frame utilization before. Universally speaking, the conductors are to be bigger and the rotators to be smaller. Thus we find the case of the above analogous, to the loading in both the transformer and in the motor running in ring frame.

- Of course, we have to analyze why the motors are getting de-rated. And that is due to the continuous running of 24 X 360 days motor run resulting in over heating of motors, the localized heat generated in the motor could not be dissipated through the motor fins to outside, as seen by the Infrared imaging; invertors-duty type running mode, lack of ventilation, high ambient surrounding conditions of the ring frame motor in the enclosure. The conditions worsen when motor is washed by the hot pneuma fill air, tangential shear stress, fluff choking the cooling off passages surrounding the motor, very poor air circulation surrounding the motor, etc. In some cases, the high inertia load prompts us to go in over motoring. **EE motor means running at low temperatures compared to equivalent Standard motor.**
- Here, we find the textile machine OEM give due respect to the load components of the ring frame, but they have to more visibly focus to the prime mover components where energy is sucked in, transmitted to main drive. Here the energy losses inside the enclosure go unnoticed daily to the user... This is one way of tropicalizing the equipment to suit the local ambient & load conditions they have to give serious thought now about this option and find low running cost solution. Power saving at the prime mover is more important and easy than done at load.
- The OEM can think of comforting the motor systems externally and internally inside the enclosure to suit the given load. In fact, this is a better and cost effective alternative than over- motoring. When we are asking our motors to deliver 90 to 94 % efficiency, the radiation losses due to over heated motor has to be first attended to. We have to give more focus to the prime mover systems in the area of Lubrication, Adequate ventilation, alignment, vibration, cooling off passages, changing load conditions etc
- When the industry is buying any machine from the manufacturer, the industry must take the initiative to ask the OEM to fix super EE motor above Eff 1 level, especially in high load factor applications even when the deal comes as package to the industry... As we know the running cost per motor is terribly high and the industry is trying to replace the existing motor, the motor OEM to give more details to the user in the Energy Saving Aspects such as the NPV, and ROI instead of the Simple Pay back period by going for Super efficiency motors more than Eff1, 2, and 3 labeled motors. **The concerned motor OEMs need to give test certificate mandatory for above similar applications.**
- If the mill is contented with the given load constraints and end breakage rates, spindle utilization etc and given spindle speed say Sub optimum speed 15000 rpm, then they don't need to over motor. In case the load warrants the mill to go in for higher spindle speed like Super Optimum speed of 20000 to 23000 rpm & above then, the mill has to necessarily over motor the ring frame. By this, then they can get higher increase in Kg of yarn for smaller increase of motor power consumption after over motoring the frame.
- In general, we find in the Transmission & Distribution Losses pattern, the losses transmitted upto the motor is constant and less to start with; whereas the distribution losses upto the spindle is more and varying. **The power transmitted to one motor is distributed to 1000 spindles via tin roller pulley, belts, gear drives etc. But over a period of time, the losses upto the motor also tends to go up due accelerated ageing of motors due to various load & ambient factors as mentioned above.**
- We know now that the Efficiency levels of 90 to 95 % offered by the motor OEMs have relevance only when compared with reference to the Standards. So the motors must be tested in the sustained & cyclic loaded hot running conditions. So when testing the motor on trial, leaving the motor on the hot running condition gives the real performance of motor in a ring frame. So instead of confusing the motor efficiency % and the standards, the industry can test run the new trial motor in this ring frame application for few days and then decide how much more the new motor is efficient to the existing motor or any other brand motor tried in the same frame & conditions.
- Previously, as an analogy, the industry is used to load to transformer to around 80 % loading and considered then, that as the optimum loading. Now after the advent of EE norms published by BEE and the industry's concern over transformer losses now, and studying their iron & copper losses we find the **transformers are best loaded around 50 % optimally. Likewise, the motor in the textile industry especially in the money spinning ring frame is working efficiently at sustained loading of 50%.**

- BEE indicates to us, in the Energy Monitoring & Targeting aspects, how to clearly demarcate the “fixed “energy consumption and “variable” consumption i.e. the Energy consumption directly related to the production in the Energy Vs Production graph. By applying this graph, to money milking machine Ring frame, we can clearly say for each frame what is Machine load (i.e. the power consumed by the machine upto the empty spindles) and what is Yarn load (the power consumed by only the yarn spun in the spindles). If each mill produces this data for any given ring frame, then it is very easy to analyze the units consumed per Kg of yarn for the given ring frame. This data has to be repeated frequently to keep check on the power levels per machine.
- Metering the Motor is very much mandatory now as far as 24 X 360 hours run mode like the ring frame application is concerned. Some mills have already put energy meters even for their short frame motor at 15 KW rating to measure the varying motor load pattern. After all, it is not always fixed load like 40 watts tube light which is constant & known to us, but it is the variable load of the motor load and load dependent. Especially on a tangential load application, the cumulative KVAH & KWH and hence the average power factor is a useful tool to assess the motor health & optimum loading level in the ring frame application. This will indicate thermal characteristic as well its ageing parameter.
- Over motoring is one of the viable solutions in this typical ring frame application. It is very much needed in the place of motors used in utilities like compressed air area etc. where the user is loading the utility motor in its Service Factor region of 1.15 either always or intermittently, it is high time same motor is not abused using the Service Factor, but it is better operated at its peak efficiency region. So Over motoring approach is nothing but, healthy running of motor suiting its thermal characteristics to load & surroundings, & this indirectly yields Sustained Energy Savings.

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