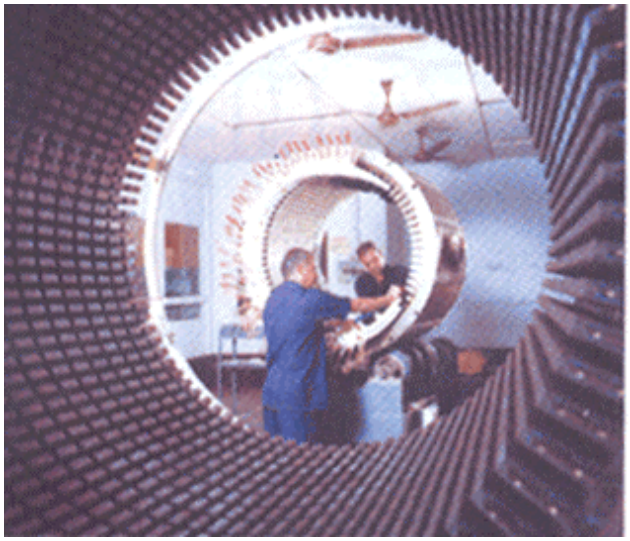


ENERGY EFFICIENT ELECTRICAL ROTATING MACHINES

CHALLENGES FOR INDIAN ELECTRICAL INDUSTRY

Introduction

All high end engineering products face a problem of becoming commodity items when their technology becomes mature. Low cost manufacturers start dropping prices and customers are prepared to take risks after having acquired some knowledge about their functioning and repairs. It happened in computers, then in TVs and recently in cell phones.

At one time electrical equipments were considered as high end products as they handled electricity which cannot be seen, its effects were fully not known and also it could cause safety issues. In India, ceiling fans and motor driven pumps which were at high end are now moving towards commodity products and so also motors.

Successful solutions are those which continuously offer better and better products in which customers find real benefits. Apart from making them compact and better looking, one of the strategy is to make them more efficient leading to win-win situation. Increasing fuel efficiency of vehicles to increase kilometers/litre by changing over to 4 stroke technology in motorbikes was one such case. Dual ignition and CRDI were also introduced to achieve the same objective. In electrical industry, introduction of CFL was one such step.

Electrical Motors

In Electrical machines, the same strategy was followed in the largest market of the world i.e. US and Canada even when energy costs were not high. It was supported by the US government as a strategic initiative to reduce dependence on energy sources from foreign countries thr'o epact regulation. Concerns about environment and global warning helped it further.

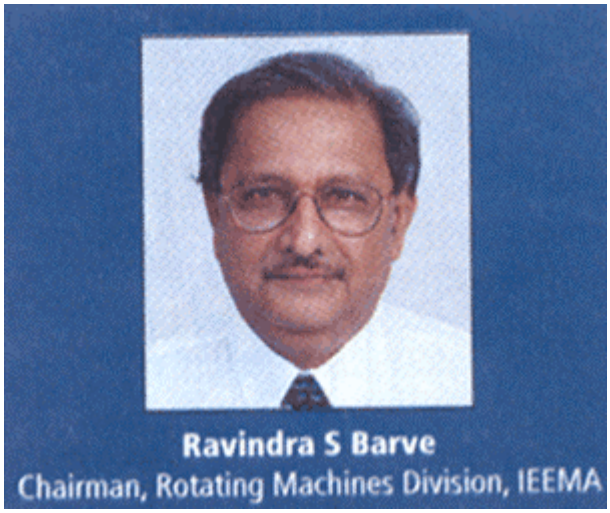
In India, IEEMA has been keeping a watch on the world trends so that Indian Electrical Industry can take action in time and does not leg behind. Rotating Machines division of IEEMA sensed the need and had formulated IEEMA standard 19:2000. It provided values by which category of motors can be judged by customers to know whether they were of improved efficiency class Eff2 or high efficiency class Eff1 or the normal prevalent Eff3 which just met IS 8789.

Various issue considered while formulating the standard were covered in the article by the same author under ref3 at the end.

This article covers the progress in last four years and challenges.

Implementation of IEEMA Standard 19:2000 for Energy Efficient Induction Motors

Considerable progress has taken place in last 4 years in creating awareness in the minds of customers and users of motors. IEEMA propagated the standard and was well supported by International Copper Promotion Council (India) popularly known as ICPCI. ICPCI conducted and continue to organise many seminars along with partners for the promotion of Energy Efficient motors which would benefit everybody in the long run.



Many companies who were convinced have started specifying Eff1 motors for their new project and manufacturers have developed their infrastructure to cater to such demand.

IEEMA members also proposed to the Bureau of Indian Standards to revise prevalent IS 12615 for Energy Efficient motors to make it contemporary and comprehensive for a wider range. This was accepted and a draft was circulated which has now gone for final printing after some minor changes.

In the meantime, Government of India formed the Bureau of Energy Efficiency with the aim to reduce energy consumption by various actions including setting of norms, audits, labelling etc. It is propagating higher acceptance norms on efficiency for various products and accepted in principle the values of IEEMA standards 19. Revised IS 12615 will be the basis for labelling of motors by BEE as energy efficient.

New Developments at IEC

International Electro-technical Commission (IEC) had assigned the task of upgrading IEC 34-2 part related to measurement of efficiency to a working group TC 2 / WG 2 (now redesignated as TC 2 / WG 28). Based on the draft prepared by the group and voting on the same by various National committees, an IEC standard 61972 (2002 – 11) is now available.

The basic principles followed were better reproducibility of test results and better co-relation with actual losses at measured load conditions including stray load losses.

While support was drawn from an established US standard IEEE 112 method B, the procedure was modified to make it more user-friendly to apply it on production machines.

While the standard was finalised, it was not acceptable to CEMEP (European committee of manufacturers of electrical machines and Power Electronics) for immediate implementation as it involves different procedure and instruments of higher accuracy and they had certain commitments with EU secretariat using earlier IEC 34-2 procedure.

This was discussed at BEE and BIS meetings and it was consciously decided that India will go ahead with the earlier method in the initial stages. That will allow manufacturers to get suitable equipments and experience with the new method although some of IEEMA members were equipped.

Measurement of Additional Load Losses (Stray) in Induction Motors

The main difference causing difficulty in the new standard is the actual determination instead of assumed value for these. It calls for a test set up where input and output powers to and from the motor under test are measured accurately. Additional load loss is determined by subtracting all known losses from the difference between input and output power. The test calls for measurement at 6 load points and then regression analysis to validate results. That calls for precise measurements on 0.2 class instrumentation compared to earlier 0.5 class. It calls for actual measurement of output and speed (thr's torque transducer/ dynamometer) and also a stable supply which was not essential earlier.

New Efforts to resolve Difficulties

CEMEP is supporting a project for determination of stray load loss by eh-star method. Although the method was known in Germany, it was not thoroughly investigated and validated. The project at Darmstad University will try to bridge this gap. It does not require motor to be coupled to any load and supply is given to only 2 phases with the motor in uncoupled condition. In addition a resistance of suitable value is inserted between the third phase and one of the directly energised phase terminal. Recent testing in the project has found the test encouraging on small motors. Additional loss determined by this method were found closer to those tested by IEC 61972 as compared to the other method with a combination of reverse rotation and removed tests. However it was found to be suitable for use on star connected motors. Implications on delta connected machines is yet to be established.

Revision of Rotating Electrical Machines Standard–IEC Specification 60034-Part 2

The standard has not been revised significantly for a long time. Assignment was given to WG28 to make it more contemporary. Basic principles which were applied as fundamental in the formulation of IEC 61972 were thought to be applied for all machines.

The first draft sent by the committee was circulated to National committees for comments which were debated in WG28 meeting held in Sept, 04. The author was present as a member and commented on various issues.

One of the critical point was the accuracy level of 0.2 class even when uncertainty level is Medium or High. BIS secretariat and committee will have to be watchful this time as the draft will come for voting.

The other issues relate to preferred method for measurement of efficiency when the difference between the values is not likely to be high or the main characteristic of that product is not efficiency (eg DC motors for speed control at low costs or small fhp motors where inherent efficiency is low). Use of 0.5% class instrumentation or assumed values of stray load loss is not going to matter much, in the opinion of the author in such cases.

Challenges in front of Indian Electrical Industry

While a temporary breather is available as CEMEP is not following IEC 61972, IS 12615 Revision and BEE will follow the existing procedure of IEC 34-2, other countries like Australia are trying to go ahead with the new standard.

Indian manufacturers will have to carry out own R and D to find out real additional load losses on their own products and ways to reduce them.

European manufacturers and particularly MNCs are mentally reconciling to the position that procedures similar to IEC 61972 will have to be followed in the long run if they have to compete against US led drive for products tested to IEEE 112 method B and will endorse it when ready. Indian manufacturers will have to also get geared up for it before manufacturers from south America and China are ready to dump their goods in Indian Market after further reduction of duties under WTO. That will need to establish methods which will deliver high efficiency with lower additional losses consistently with even lower costs than present Eff1 motor costs.

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