Chapter 8

Conclusion

8.1 PERFORMANCE OF THE MOTOR

This thesis dealt with the performance calculation of an induction motor with MATLAB programming and experiments on winding insulation and turns insulation and hence life for medium voltage motor. The performance is calculated using direct load test, equivalent circuit and modified equivalent circuit for two motors: (1) Frame 63, 3-phase, 415 V, 470 W, 1.3 A, 50 Hz, 2-Pole, Class F, Continuous duty Induction motor and (2) Frame 63, 3-phase, 380 V, 470 W, 1.4 A, 50 Hz, 2-Pole, Class F, Continuous duty Induction motor.

The modified equivalent circuit parameters method gives the performance values within acceptable limit and eliminates the evaluation of friction and windage loss. While calculating the efficiency of the motor stray load losses is taken as 1.85% of the output as mentioned in IEEE-112. Hence this method and MATLAB programs given in chapter can used for calculating the performance of motor.

8.2 TURN INSULATION

The maximum voltage recorded for these 230 V (phase value) induction motor when operated with converter is 1133.9 V (KRK0033) whereas the as per IS 4800 voltage with stand capability of enamel of 27 and 28 swg wire is 2800 V. This indicates that motor having phase voltage 567.95 V ((2800*230)/1133.9) can work on this converter safely.

However, turn insulation can fail for a number of reasons, not all of them within control. In general these could be design, quality, and site condition related:

1) The dielectric stress due to the surge exceeding the capacity of the turn insulation;

2) A much larger number of surges per unit time than was foreseen when the motor was specified and designed;

3) Insulation degradation over a time under the influence of normal dielectric and thermal stresses, moisture, vibration, and contaminations;

4) Turn insulation erosion due to corona if voids exist in locations next to the turn insulation, resulting in partial discharge; this is likely to happen at voltage greater than 6000 V and with voids larger than 0.05 mm in diameter;

5) Turn insulation erosion over time if due to high vibration, repeated start, and speed switching, the insulation work loose and relative movement becomes possible between individual turns in a coil;

6) Inadequate or absent routine and preventive maintenance of the motor;

7) A much more hostile surge environment than was originally envisioned.

Therefore, following points are to be considered while designing the inter-turn insulation.

1. Knowledge of the surge environment in which the motor is to operate is necessary in determining the surge capability requirements of the motor.
2. Although system studies can be made to determine the worst case surge that might impinge on the motor winding, the monitoring of surges at a number of sites on an industry-wide basis over a period of time is desirable to develop a better feel for surge requirements.
3. The surge capability specified for a motor should be based on application requirements, not simply on any particular standard. This is so because actual requirements might be the same, less, or greater than what the standards require.
4. Higher than necessary level of surge capability and specified dedicated turn insulation are not quite "free". Both the size (first cost) and the efficiency (operating expenses) are adversely affected. Dedicated surge protection equipment for the motor should be considered as a factor in the economic analysis for motor selection.
5. The application of dedicated turn insulation is no guarantee of freedom from failure. If the surge amplitude, rise time, and frequency of surges per unit time are higher than those specified, dedicated turn insulation can also fail.
6. In critical applications, irrespective of the level and type of turn insulation specified, the use of dedicated surge protection should be considered.
7. A large number of motors are functioning satisfactorily with a surge capability of 2 pu. It is not necessary to make a global switch to higher surge capability windings, since in many applications the surge environment is not very hostile.
8. A need exists for a standard definition for surges withstand capability of stator winding turn insulation. This definition should address not only the amplitude and rise times, but also the number of such surges that the insulation must be capable of withstanding.

8.3 EXTENSION OF WORK

For calculating the efficiency of the motor stray load losses is taken as 1.8 % of the output power as suggested in IEEE-112. This value of stray load losses gives somewhat higher efficiency than the actual hence further experimentation is required to fix the value of stray load losses.

In conclusion it is estimated that motor having 567.95 V (Phase value) can safely with stand the surges produced by the converter. So further experimentation can be done in this direction to confirm this.