

Surge Protection

Important considerations for motors

Some users of medium voltage motors argue the fact that an optimized surge protection arrangement eliminates the risk of motor failure resulting from switching surges. The issue really is whether the cost of surge protection is economically feasible compared to the risk of motor switching surge failure. The other argument is the type of protection arrangement that should be used.

The motor manufacturer cannot be expected to admit that his motors are generally susceptible to switching surges. Likewise switchgear manufacturers are also unlikely to recommend surge protection for motors in the facility and remain price competitive with their products. It is therefore left to the user to decide whether or not to install surge protection.

Laboratory tests can provide totally unrealistic results, particularly if high frequency circuit parameters are not realistically simulated. The guidelines for motor surge protection are based on many field tests involving actual motor installations.

The objective here is to provide general guidelines concerning the application and configuration of surge protection. Protection is generally recommended for all applications where reasonable doubt exists as to the ability of a given motor to survive switching surges over its life span. Consideration must be given to economic factors in the sense that the cost of the surge protection does not outweigh the cost of related failures which could otherwise be expected.

It is important to note that an inter-turn failure is generally associated with a localized low-energy discharge which is unlikely to cause an immediate coil-to-coil-slot failure on the motor. However, once the turn insulation has been pin-holed, subsequent switching operations may cause further breakdown at a much lower voltage. This process may be repeated over a considerable period of time before a major coil insulation failure occurs. Optimized surge protection is therefore also aimed at eliminating further failures in a coil which was previously slightly damaged, but which has not yet failed.

Cost Implications of a Switching Surge Failure

Risks in terms of the total cost associated with failure of a specific motor should always be determined by the user. The following factors - which are not always obvious - should also be taken into consideration:

1. Production Loss

- a) The quality of the rewind (i.e., whether the impulse withstand voltage will be the same as for the original motor or whether the risk of a second failure will be higher).
- b) The cost of a rewind, taking into account cost differences between a "normal" rewind and a "superior" rewind, which could be quite substantial.
- c) Long term insulation degradation due to localized non-catastrophic inter-turn faults, which may eventually cause failures of several motors over a relatively long period, but which can not always be reversed once the first series of failures has drawn attention to the need for surge suppression.

2. Type of Switchgear and Switching Duty: It is commonly accepted that a surge protection should be provided in all cases, regardless of motor size, impulse withstand characteristics or switching duty. This applies to vacuum contactors, circuit breakers, and claims by manufacturers.
- a. Vacuum Switchgear: It is commonly accepted that a surge protection should be provided in all cases, regardless of motor size, impulse withstand characteristics or switching duty. This applies to vacuum contactors, circuit breakers, and claims by manufacturers.
 - b. Air & SF6 Switchgear:
 - i. For special design motors where impulse withstand is at 4pu at 0.2 usec. surge protection is not required in the following cases:
 - Low Switching duty i.e.. typically one or two switching operations per week
 - If the motor is not used for essential processes.
 - If the motor is not used for "jogging" or similar applications
 - If the total cost of a failure is relatively low compared to the cost of the surge protection
 - ii. For standard design motors surge protection is not required in the following cases:
 - Low switching duty i.e.. not more than a few switching operations per month.
 - If the motor is not used for essential or semi-essential processes
 - If the cost of a failure is relatively low compared to the cost of surge protection.

These guidelines should be reviewed and consideration given to a possible installation of surge arrestors at the panel where the switching device of the motor is located.