



SNS COLLEGE OF ENGINEERING

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19EE605 PROTECTION AND SWITCHGEAR

III YEAR /VI SEMESTER

Unit 1- PROTECTION SCHEMES

Topic: Essential Qualities of Protection



ESSENTIAL QUALITIES OF PROTECTION



The basic requirements of a protective system are as follows:

- (i) Selectivity or discrimination
- (ii) Reliability
- (iii) Sensitivity
- (iv) Stability
- (v) Fast operation



(i) Selectivity or Discrimination



- It is the **quality of protective relay** by which it is able to discriminate between a fault in the protected section and the normal condition.
- Also, it should be able to distinguish **whether a fault lies within its zone of protection** or outside the zone.
- Sometimes, this quality of the relay is also called discrimination.
- When a fault occurs on a power system, only the faulty part of the system should be isolated.
- The relay should also be able to discriminate between a fault and transient conditions like power surges or inrush of a transformer's magnetizing current.
- The magnetizing current of a large transformer is comparable to a fault current, which may be 5 to 7 times the full load current.



- When generators of two interconnected power plants lose synchronism because of disturbances, heavy currents flow through the equipment and lines. This condition is like a short circuit.
- The flow of heavy currents is known as a power surge. The protective relay should be able to distinguish between a fault or power surge either by its inherent characteristic or with the help of an auxiliary relay.
- Thus, we see that a protective relay must be able to discriminate between those conditions for which instantaneous tripping is required and those for which no operation or a time-delay operation is required



(ii) Reliability



- A protective system must operate **reliably** when a fault occurs in its zone of protection.
- The failure of a protective system may be due to the failure of any one or more elements of the protective system.
- Its important elements are the protective relay, circuit breaker, VT, CT, wiring, battery, etc.
- To achieve a high degree of reliability, greater attention should be given to the **design, installation, maintenance and testing** of the various elements of the protective system.
- Robustness and simplicity of the relaying equipment also contribute to reliability.
- The contact pressure, the contact material of the relay, and the prevention of contact contamination are also very important from the reliability point of view.
- A typical value of reliability of a protective scheme is 95%.



(iii) Sensitivity

- A protective relay should operate when the magnitude of the current exceeds the preset value.
- This value is called the pick-up current.
- The relay should not operate when the current is below its pick-up value.
- A relay should be sufficiently sensitive to operate when the operating current just exceeds its pick-up value.



(iv) Stability



- A protective system should remain stable even when a large current is flowing through its protective zone due to an external fault, which does not lie in its zone.
- The concerned circuit breaker is supposed to clear the fault.
- But the protective system will not wait indefinitely if the protective scheme of the zone in which fault has occurred fails to operate.
- After a preset delay the relay will operate to trip the circuit breaker



(v) Fast Operation

- A protective system should be fast enough to isolate the faulty element of the system as quickly as possible to minimise damage to the equipment and to maintain the system stability.
- For a modern power system, the stability criterion is very important and hence, the operating time of the protective system should not exceed the critical clearing time to avoid the loss of synchronism.
- Other points under consideration for quick operation are protection of the equipment from burning due to heavy fault currents, interruption of supply to consumers and the fall in system voltage which may result in the loss of industrial loads.
- The operating time of a protective relay is usually one cycle. Half-cycle relays are also available.
- For distribution systems the operating time may be more than one cycle.



Assessment



1. What is the actuating quantity for the relay?
 - a) Magnitude
 - b) Frequency
 - c) Phase Angle
 - d) All of the above.





References



1. SuniS Rao, “Switchgear, Protection and Power System (Theory, Practice & Solved Problems)”, Khanna Publishers, New Delhi, 2019.
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3. Badriram, Vishwakarma B.H, “Power System Protection and Switchgear”, New Age International Pvt Ltd Publishers, 2nd Edition 2017.

Thank You