Overcurrent Protection

Recommended Settings

Transformer Protection

Normally the transformers are protected by overcurrent protection devices at the primary (HV) and secondary (LV) winding.

The primary winding overcurrent protection is typically set with three steps:

- The first step (I>) is adjusted to between 1.0 and 1.3 times the nominal current of the transformer with an inverse curve. A pickup of >1.25 times the nominal current is suggested by [6].
- The second step (I>>) operates as back-up protection for short circuits at the secondary side of the transformer and is adjusted to 80% – 90% of the minimum possible short circuit at the low voltage terminal. This step is usually a definite time curve and is time selective with the protection at the secondary side.
- The third step (I>>>) operates in instantaneous time and is adjusted to 110% - 120% of the maximum possible short circuit at the secondary side of the transformer. If the relay has only two steps, the second step will be adjusted according to I>>>.

The secondary winding overcurrent protection is typically set with two steps:

- The first step (I>) is adjusted to between 1.0 and 1.3 times the nominal current of the transformer if possible with an IDMT extremely inverse curve. A pickup of >1.25 times the nominal current is suggested by [6].
- The second step (I>>) is used for short circuit protection and it is usually a definite time curve. The current setting of I>> is at maximum 80-90% of the minimum possible short circuit current and it has to be time selective with the downstream protection devices.

Protection devices should also consider transformer inrush currents. Overcurrent relays should not trip during energisation and inrush. An assumption of 20 times the nominal full load current for 10ms can be used to approximate inrush currents when no other data is available.

Motor Protection

Thermal overload [49]: The current setting has been adjusted where possible between 1.0 and 1.1 times the motor nominal current. The nominal current of the motor has been taken from the load lists supplied by Petrobel staff. The time setting has been selected in order that the protection curve lay over the starting current at the maximum starting time

of the motor but lower than the maximum permissible operation limit under warm condition.

Short circuit and locked rotor protection [51, 51LR]: The setting for locked rotor protection has been selected between 1.0 and 1.1 times the motor starting current. The short circuit protection has been adjusted at maximum 80-90% of the minimum short circuit current at motor terminals but at least 1.5 times the starting current of the motor. The short circuit protection of almost all motors is done by fuses. Nevertheless in this study the setting for the short circuit protection has been calculated for all relays with this protection function available. For all motors where the contactor is not able to disconnect short circuit currents the undelayable short circuit protection has to be put out of service. The size of the recommended fuse has been selected in order that the nominal current of the fuse is higher than 130% of the nominal current of the motor and that the fuse curve is higher than 120% of the starting current of the motor.

Branch / Feeder Protection

Branches and feeders can be set with overcurrent protection devices of two steps. The first step will be usually adjusted to 120% of the nominal current of the branch. The second step has to be current and time selective with the downstream protection devices.

Generator Protection

The setting for the overload protection is suggested to be between 100% and 120% of the nominal current of the generators. The short circuit protection may be selected to 80% of the current contribution of each generator to the minimum short circuit current.

References

- [1] IEEE Std 242, "IEEE Recommended Practice for Protection and Coordination – Industrial and Commercial Power Systems (Buff book)", 2001
- [2] IEEE Std 142, " IEEE Recommended Practice for Grounding of Industrial and Commercial Power systems (Green book)", 2007
- [3] Alstom Grid, " Network Protection and Automation Guide", May 2011
- [4] Preve, C., "Protection of Electrical Networks", 2006, ISTE Ltd, London
- [5] Fielding, G., "Protection of MV Industrial Networks", 1997, IEE Colloquium, London
- [6] Gers, J. M., and Holmes, E. J., "Protection of Electricity Distribution Networks", 2nd Edition, Institution of Electrical Engineers, London, 2004