Flashover protection for transformers supplying low-voltage networks which are not directly earthed

In the notes to paragraph 5 C in the Swedish Safety Regulations, flashover protection is recommended for transformers in low-voltage networks that are not directly earthed. The attached diagrams 7454 080 and 7454 081 show the ASEA standard design of this protection when the step-down network consists of only a.c. network or a.c. network + d.c.-supplied motors.

A.C. network (diagram 7454 080).

A neutral-point voltage transformer 2:b with the following ratio is connected to the low-voltage neutral

\[
\frac{440}{\sqrt{3}} \quad \text{or} \quad \frac{550}{\sqrt{3}} \quad 110 \text{ V}
\]

for networks with a service voltage of approx. 380 - 400 V and approx. 500 V, respectively. The voltage transformer is connected to an over-voltage relay 3:a, which should be set for approx. 50% over the maximum neutral-point voltage when earth-faults occur in the low-voltage network, i.e., for approx. 150 V. The relay instantaneously trips the high-voltage circuit-breaker of the transformer via an auxiliary relay 3:c. In addition, a neutral-point voltage relay 3:b, which can be adjusted from 25 - 50 V for signalling upon the occurrence of earth-faults in the low-voltage network, can be connected to the voltage transformer.

A.C. network + rectifier-supplied motors (diagram 7454 081).

In this case it is not possible to use a voltage transformer because, for example, an earth-fault in the d.c. network can rapidly damage this transformer if the earth-fault is not removed in time. Immediate tripping upon the occurrence of an earth-fault is often not possible owing to the working processes in operation.

An over-voltage relay 3:a, which should be set for approx. 150% of the max. neutral-point voltage upon earth-faults in the low-voltage network, should in this case be connected directly between the neutral and earth. The relay instantaneously trips the high-voltage circuit-breaker of the transformer via an auxiliary relay 3:c. In addition, a neutral-point relay 3:b for signalling, when there is an earth-fault on the low-voltage side, should be connected between the neutral of the transformer and earth.
Since harmonics occur to a large extent when motors are thyristor-excit ed, the neutral-point voltage relay has to be fitted with a harmonic filter. Further information on the selection of scale for this relay is given in information sheet RK 60-321 E. Here instructions are also supplied together with data required for ordering a neutral-point voltage protection of type RYEIA, which gives selective indication of earth-faults in the a.c. and the d.c. network respectively.

PROTECTIVE DEVICE

If there is a flashover in the transformer from the high- to the low-voltage side, the latter may receive so high a voltage that flashover to earth occurs immediately and before the voltage relay 3a has time to operate. After flashover, the relay receives insufficient voltage for operation. In order to eliminate the risk of flashover, a voltage-dependent protective resistor 2a is connected in parallel with the voltage transformer and the relays. This limits the voltage to earth to a max. of approx. 2000 V peak value if the earth-leakage current of the high-voltage network does not exceed 25 A. If two resistors are connected in parallel, the voltage is limited to the same value for earth-leakage currents up to 50 A. However, the resistors withstand these earth-leakage currents for only a very short period, so that they can only be used in combination with flashover protection for instantaneous tripping. On the other hand, the resistors withstand continuously the full phase voltage of the low-voltage network upon the occurrence of earth-faults, but different resistors are required for a service voltage of max. 440 V and 550 V, respectively.

The voltage transformer and the protective resistor are designed as a complete protective unit type SLWJ incorporated in a light-alloy box. Also the protective resistor alone is built into a light-alloy box.

TESTING

For testing the earth-fault protection and checking that the circuit to the relays is not broken (protected by fuse 4), a testing equipment can be set up. It consists of an adjustable resistor (5) which is connected in with a switch (6), and the alarm for earth-fault is obtained. If not, the fuse may have blown.

INFORMATION NEEDED WHEN ORDERING

The equipment described above can be ordered with the help of diagrams 7454 080 and 7464 081. The order should also include the earth-leakage current in the high-voltage network.
HV to LV flash-over protection and general earth-fault alarm in low-voltage networks.

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<th>7454 080</th>
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Lågspänningsnät  
Low voltage network  
max 550V

Alarm
Earth-fault

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| Relay case: RHGA6 with:  
1: a RREL 24-1517 voltage relay 100-200 V  
2: b RREL 23-1514 voltage relay 26-50V  
3: c RRMF 18 tripping auxiliary relay with indicating flag  
| Protective device: SLW1 3860 acc. to  
3860 1400-A for 440V or  
3860 1400-B for 550V consisting of a light metal casing with:  
| 2: a MXA 074-A protective resistor at 440V  
| MXA 074-B protective resistor at 550V  
| b SLMA 3860 voltage transformer:  
| oms. 440-550 / 110V  
| V3  
| Automatisk bruteare  
Automatic circuit breaker  
Np. Item  

Om jordslutningsströmmen i högspänningsnätet är > 25A men <= 50A
If the earth leakage current in the high voltage network is > 25A but <= 50A
Two protective resistors 2a connected in parallel are required.
ASEA
Västerås

Överslagsskydd för transformator och allmän jordfelssignal för lågspänningsnät med likriktare.

HV to LV flash-over protection and general earth-fault alarm in low-voltage networks with rectifiers.

1 Lågspänningsnät
Low voltage network max 550V

2 Likriktare
Rectifiers

3 Prov
Testing

4 Signal Alarm

5 Jordfel Earth-fault

6 Manöverställare eller tryckknapp
Switch or pushbutton

7 Matslång MRB 104-1600

8 Sökring 6A

9 Relähalje RHGA 8 med:

: ARRE 24-1519 sp.-relä 250-500V
: B RREL 22- - - sp.-relä
: C RRME 18 utlösande hjälprelä med indikeringstflagg

10 Skjutplacering

11 Protective device acc.to

12 3400 4409-A för 440V

13 3400 4409-B för 550V

14 best av lättermetallad med:

MXA 074-A skyddsomslagt vid 440V
MXA 074-B skyddsomslagt vid 550V

15 Automatic brytare

16 Automatic circuit breaker

Om jordslutningsströmmarna i högspänningsnätet är > 25A men ≤ 50A

erfordras två parallellkopplade skyddsmotstånd.

It the earth leakage current in the high-voltage network
is > 25A but ≤ 50A two protective resistors connected
in parallel are required.