Transformer GIC Blocking System Attributes
Considering Good Utility Practice

Note: the term “Blocking” meets blocking or reducing GIC in the neutral connection of the power transformer.

Description of application

Blocking Components

1. **Description of Design / Component**

2. **Diagram of system**

3. **List of Component (size and rating)**

4. **List the components that are Electric Utility Proven**

5. **List the components that have limited duty cycle or number of operations?**

Principles of Operation

1. **Does the Blocking Design block or reduce GIC in the neutral connection? (Resistor or Capacitor based)**

2. **Is the component blocking GIC in service all the time?**

3. **If not, when and under what condition is it placed in service?**

4. **If not, how is it placed in service?**

5. **Remove from service?**

6. **Does the Blocking Design provide data to the System Operator**:
    a. **GIC – Magnitude**
    b. **GIC-Polarity**
    c. **Harmonics (if so, which ones)**
    d. **Steady state neutral AC current**
    e. **Steady state neutral voltage**
    f. **Transient neutral voltage**
    g. **Neutral Fault Current**

h. **Status of switches**

i. **Capacitor Pack Failure or imbalance (Capacitor Fuseless or internally fused)**

j. **Blocking Device Temperature**

k. **Bypass status-normal conditions**

l. **Bypass status-transient conditions**

m. **Arrester Failure**

7. **Has the Blocking Design been analyzed with a continuous 200 amp AC neutral current?**

   If so, provide detail of the analysis.

8. **Has the Blocking Design been analyzed with a continuous 200 amp AC neutral current and GMD event?**

9. **If so, provide detail of the analysis.**

10. **Considering a continuous 200 amp AC neutral current, what are the annual MW losses under the Blocking Design?**

11. **What are the known modes of mis-operation? Any known remedies?**

12. **Any back-up devices or procedures?**

Design / Installation

What is the footprint size?

Where is the proposed installation, i.e. attached to transformer infrastructure, substation steel, stay alone, etc.

Is the design complaint with the following IEEE/ANSI standards and codes?

a. **IEEE-18 IEEE Standard for Shunt Power Capacitors**

b. **IEEE 32 Standard: Requirements, Terminology, and Test Procedure for Neutral Grounding Devices**

c. **IEEE C62.92 Standard, Guide for the Application of Neutral Grounding in Electrical Utility Systems**

d. **IEEE C62.11 IEEE Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits**

e. **IEEE-80 IEEE Guide for Safety in AC Substation Grounding**

f. **IEEE-824 IEEE Standard for Series Capacitor Banks in Power Systems**

g. IEEE-1531 IEEE Guide for Application and Specification of Harmonic Filters

h. ANSI – C2 - NESC National Electrical Safety Code

i. ANSI-C92 Power Systems - Alternating-Current Electrical Systems and Equipment Operating at Voltages Above 230 kV Nominal-Preferred Voltage Ratings

j. ANSI-C37.012 Application Guide for Capacitance Current Switching for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

k. ANSI-C37.30 High Voltage switches

l. ANSI-C37.32 Fault initiating and ground switches

m. ANSI-C37.33 High Voltage switches

n. ANSI-C37.34 High Voltage air switches

o. ANSI-C37.35 Operation and Maintenance of High Voltage switches

List any Technical literature available on the Blocking System?

List any operational experience with the Blocking System?

Resonance Consideration

Fault Performance

Have overvoltages from line-ground faults been analyzed on the neutral? If so, describe the nature of the analysis.

On the unfaulted phases, particularly the effect on the performance and rating of line to ground arresters and potential transformers, are the results within BIL specifications?

Has the Blocking Design been evaluated on the impact to relay settings or relay performance?

Please describe the Relay coordination study or update.

Will the reduction in ground faults require relay settings changes?

Will insertion of blocking devices have a negative impact on breaker duty?

Has the Blocking Design been studied for fault current levels of 30,000 amps?

If so, can the component blocking the GIC handle 30,000 amps for 6 cycles?

If not, what is the method to protect the blocking component?

What is the rating of the protection method?

What is the duty cycle of the protection method?

How many faults can the blocking component protective device handle?

Is there a specified period between faults (i.e. cool off period)?

What will the state of the Blocking Design be for a second fault from an automatic reclose within 1 sec?

Serviceability

What type of maintenance does the Blocking Design require?

When does the Blocking Design need to be maintained?

Any recommended practice?

Can the Blocking System be removed from service for maintenance without a transformer outage? If so, please describe

To place in service?

If not, explain how the Blocking Design is maintained without an outage to the transformer.

What is the potential that the Blocking Design is no longer providing a grounded neutral?

Is there any indication that Blocking Design is no longer providing a grounded neutral to the transformer?

General

What is the approximate installed cost (including design and engineering costs) per transformer? Less than $50K, $50-$100K, $100K-$200K, $200K-$300K, greater than $300K?

Are their patents or patents pending on the Blocking System?

Is there any Department of Commerce PTO device certifications?

Is the Block Design hardened against EMP events?

Please explain E1, E2 and E3 wave protection