P21 93027

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RECORD OF EVALUATION FOR CFR21

Product: ABB K-4000 Circuit Breaker

1) Description of Deficiency

ABB type K-4000 circuit breaker does not meet all requirements of rating based on ANSI C37.16, Table 1, as tested per C37.50, Table 3, tests 4, 5, and 6. Tests 4 and 5 show satisfactory performance at 65kA and test 6 shows satisfactory performance at 85kA.

2) Location/Date

Testing was performed at the KEMA-Powertest laboratory in Chalfont, PA in November, 1992. Manufacturing is in the ABB Power Distribution Circuit Breaker Division plant in Florence, SC.

3) Analysis of Safety Implication

In applications where rated maximum voltage may appear across a single circuit breaker pole, the arc may not be extinguished as the circuit breaker is opening. Some examples of applications wherein this may occur are as follows:

a) Un-grounded delta source with two unintentional grounds; one on the source side of a breaker pole and one on the load side of a different pole (Figure 1).

b) Corner-grounded delta source with an unintentional ground on the load side of the pole of either un-grounded phase (Figure 2).

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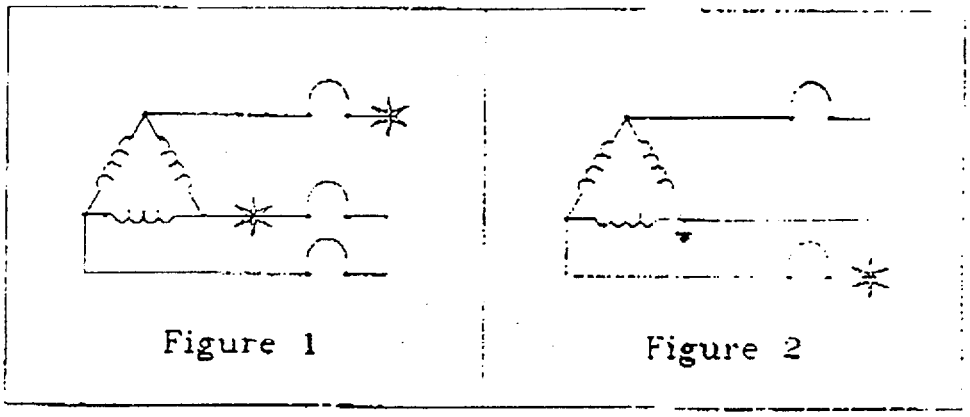

Figure 1 Figure 2

c) Un-grounded Y source with two unintentional grounds; one on the source side of a breaker pole and one on the load side of a different pole (Figure 3).

d) Single phase source with intentional or unintentional ground on source side of one breaker pole and unintentional ground on load side of the other breaker pole (Figure 4).

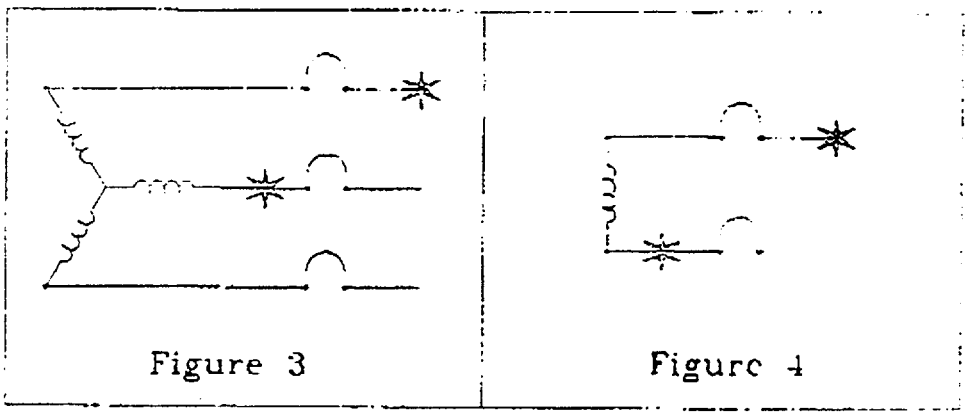

Figure 3 Figure 4

4) Steps to be Considered in the Evaluation and Personnel Assigned

a) Analysis: Analysis consists of examination of arc chutes and contact structures returned from the KEMA-Powertest laboratory following unsuccessful tests. Known principles of arc interruption and engineering judgment are being combined to improve the performance sufficiently to meet the ANSI ratings.

b) Calculations: N/A

c) Tests: Full range of interrupting tests listed in 1) above will be made after

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arc chute modifications have been made.

d) Trip to Jobsite: N/A because no failures of the nature being reported herein have been communicated.

e) RGA: None required at this time.

f) Inspection Factory/Field: Application should be examined when the K-4000 circuit breaker is used in the field. If any of the applications described in section 3) above exist, modifications should be made in accordance with ABB findings.

Personnel Assigned: Gregory Grote - Product Development Engineer
Kevin Warne - Designer
Robert McMaster - Consultant

5) Documents or Drawings Requiring Change

Only change now contemplated is to replace a total of (5) five arc chute parts with parts described in (5) five new drawings.

6) Reference Documents

American National Standards Institute standards as follows: ANSI C37.13, ANSI C37.16, ANSI C37.50

7) Corrective Action

ABB has scheduled tests on the modified arc chutes in several different modes at the KEMA-Powertest laboratory in Chalfont, PA. Tests will be conducted in early February, 1993.

8) Action to Prevent Recurrence

Put successfully tested new design into production via standard engineering release system for revised parts and assemblies.

9) Conclusions

a) If a particular application does not allow the conditions described in section3) above, there is no safety hazard.

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b) Regardless of the transformer connections in a particular application, a three phase transformer rated at 2500 kVA or less with 480 Volts secondary will not produce the safety hazard. This is because the available current will not exceed the current for which we have successful tests per section 1) above. The following calculations supports this conclusion:

kVA = 2500

Assumed transformer impedance (Z) = 5.75%

Secondary Voltage = 480 VAC

Assume 100% motor load contributing 4x transformer full load current to the magnitude of available current

Full load transformer current, I_{FL} = (kVA x 1000) / (E x 3½)
= 3007 Amperes

Available current from transformer, $I_{AT} = I_{FL}$ / Per unit Z
= 3007 / .0575 = 52,300 Amperes

Motor contribution current, $M_C = 4 \times I_{FL}$
= 12,028 Amperes

Total available current $I_T = I_{AT} + M_C$
= 64,350 Amperes

(The above conservatively assumes an unlimited primary capacity.)

W. P. Gibson
Vice President, General Manager

Bill Book
Engineering Manager

Wendell Jones
Quality Assurance Manager