



Canadian Standards Association
Mississauga, Ontario
To the Part I Committee

Subject No. 2314

Chair: F. Kaempffer

Date: January 23, 2004

Title: Request for an Interpretation of Rule 36-306(5) – now Rule 36-308(6)

Submitted by: Ark Tsisserev of The City of Vancouver on August 21, 1992.

Proposal: Request for an Interpretation of Rule 36-306(5) – now Rule 36-308(6) as follows:

Question:

Is the requirement of this Subrule applicable for a transformer connected to a grounded neutral system, where such a grounded neutral system represents:

- (a) High voltage (primary side)
- (b) Low voltage (secondary side)

Reasons for Request: Many designers question the requirement for a neutral of a low voltage side of a transformer to comply with Table 51, when a grounding conductor on the supply side of the service disconnecting means, which is fed from the secondary (low voltage) side of the transformer, is only required to be sized in accordance with Table 17 even if a ground fault current at the service disconnecting means may be of the same magnitude as the fault current at the transformer secondary.

Chair's Comments:

- (1) The answer to both (a) and (b) is “Yes”. Although the concern behind the Rule relates primarily to the high voltage (primary side), it does not provide for any exclusion on the low voltage side.
- (2) It should not be overlooked that on many stations the transformer may be as large as 20 MVA and the secondary voltage as high as 13.8 kV, thereby being capable of producing relatively large ground fault currents. The return path through the neutral to earth may not keep the ground potential rise to acceptably low values.

Note that the rule as it appears in the sixteenth edition is missing the words “shall be connected to the Station Ground Electrode”.

Subcommittee Deliberation: The six members who replied indicated agreement with the Chair's comments. Two made additional comments:

I agree with the Chair that both neutrals are to be grounded. The station ground could be used for both but they could also be far enough apart to be different systems. This would make the secondary ground at the service mandatory and more effective.

Agree with the Chair's comments except higher secondary voltages result in lower secondary currents (Comment 2)

Subcommittee Recommendation: That the answer to both parts of the question be "Yes".

Chair's comments (Second Round) This item was returned to the Subcommittee at the 91st meeting. The original submission predates me by two Subcommittee Chairs. As I understand it, there was a concern at the time about a Section 36 interpretation applying to the low voltage side of a transformer and the profound implications this could have on other rules. I also note that the original submission pertains to Rule 36-306(5) which is now numbered 36-308(6) in the Eighteenth (1998) Edition. As a starting point I suggest we first look at the definition of a "station" which means "an assemblage of equipment at one place..... for the conversion or transformation of electrical energy and for connection between two or more circuits." In my view, a transformer becomes a station under this definition provided at least one winding is energized at a voltage above 750 V. The transformer provides the connection between at least two circuits as the primary and secondary would be considered two separate circuits. The secondary circuit could be a low voltage circuit.

Secondly we should look at the purpose of the grounding conductor. The handbook tells us under intent for 36-308(6) that the transformer neutral on a grounded system be connected to the station ground electrode by a grounding conductor not less than 2/0 AWG copper. The grounding conductor shall have sufficient ampacity to carry the maximum ground fault current as specified in Table 51, and be in addition to the requirement of Subparagraph (2)(b)(i).

The crux of the matter revolves around possible fault current paths to ground at the transformer. The path could be to the transformer tank or, internally or externally to a transformer neutral connection. Whether the neutral is on the high side or the low side or both is irrelevant. The Rule tells us that a transformer neutral on grounded systems shall be connected to the station ground electrode by a minimum No. 2/0 AWG copper conductor. The interesting thing about Table 51 is that it only goes down to a fault duration of 0.5 seconds. If the maximum fault duration of the system is say 10 cycles, then a considerably smaller wire could, in theory, be considered.

I conclude, therefore, that the answer is "yes" for both (a) and (b) of the submission and note that connection of the ground wire is made at the transformer.

Subcommittee Deliberations (Second Round)

Out of eleven members (including the Chair) there are seven "agrees", two "agree with comments", one "disagree" and one no response. The two respondents with comments and the one respondent who disagrees raise the same point, namely, that consideration should be given to other than solid grounded systems (e.g. high resistance ground and neutral grounded via current limiting device). The Chair recognizes that a good point is made, but feels that it goes beyond the literal interpretation of the Rule. As such, it could be presented as a new subject. The Chair notes, the scope of Section 36, talks about applicability to voltages in excess of 750 V and being amendatory to general requirements of the Code for installations operating at 750 V or less. Hence, it would appear that Rule 36-308(6) pertaining to 2/0 AWG copper and Table 51

grounding wire size requirements supercede wire sizes given elsewhere in Rules such as 10-1108(1)(c).

Subcommittee Recommendation (Second Round)

The answer is "yes" for parts (a) and (b) of the question.

Chair's Comments (Third Round): The sub-committee recommendation from the second round was defeated by the main committee at the 107th meeting in Victoria on the basis of a disagreement with the "yes" recommendation for part (b) of the question. The rationale was that if the secondary voltage is less than 750 V, Rule 36-308(6) would not apply. Instead, Section 10 Rules apply because Section 36, under Rule 36-000(3), is only amendatory to the general requirements of the Code for voltages exceeding 750 V.

Chair's Recommendation: That we reconsider our position and recommend a literal interpretation of "yes" to (a) and "no" to (b). Once accepted by the main committee, amend Rule 36-308(6) to remove the ambiguity under a new subject (per Rule C10.10) that also considers the safety aspects of neutral grounding for transformers having a high voltage primary and a low voltage secondary.

Subcommittee deliberation (fourth round): Nine subcommittee members responded to the 4th round. All voted "yes" to part (a) of the interpretation. For part (b) of the interpretation, seven voted "no" and two voted "yes". One comment for the (b) "yes" vote is: Subrule 36-000(1) says "This Section applies to installations operating at voltages in excess of 750 V". It does not say "applies to the part of installations operating at voltages in excess of 750 V". Subrule 36-000(3) reinforces this. The second comment for the (b) "yes" vote is: Using Table 51 will ensure that the ground conductor will withstand the fault current it may see. Table 17 specifies minimum size only for the ground conductor. A short circuit study is necessary, in addition, to select the proper size conductor.

Chair's comments (fourth round): A "yes" consensus is reached for question (a). For question (b) we do not have a consensus, rather a majority opinion of "no". However, two significant points around (b) were raised, one pertaining to ambiguity in the Code and the second to safety. The Chair feels comfortable with publishing a "yes" answer to (a) but uncomfortable with publishing a "no" answer to (b). Because we have a hung jury after the fourth round on question (b) the Chair is making a recommendation on behalf of the subcommittee to the main committee without further subcommittee deliberations:

Subcommittee Recommendation (fourth round): Accept "yes" as the interpretation for part (a) of the question. Do not publish an answer to part (b) of the question.

Close Subject 2314 on the understanding that the Section 36 Subcommittee will revise Rule 36-308(6) to address the issues around part (b) of the interpretation question under a new subject number. The Subcommittee asks for direction from the main committee on who will put forward a proposal for the new subject.