

Date: 27-August-2002

To: D. J. Lemmerman, Chair
Switchgear Assemblies Subcommittee
IEEE PES Switchgear Committee

From: P. W. Dwyer
Chair, C37.59 Working Group

Subject: C37.20.3 - Next Revision

A discussion arose concerning interlocks in C37.20.3 type equipment during the revision of C37.59. Mr. Nourse requested consideration for addition of interlocks to C37.20.3 fused equipment when backfeed is possible. Note attachment 1 for details. It is also contemplated that Mr. Nourse will attend the next Switchgear Assemblies meeting to elaborate on his concerns.

This was considered beyond the scope of the C37.59 document and it was agreed that this topic should be directed to the Switchgear Assemblies Subcommittee for consideration at the next revision of the C37.20.3 document or other appropriate action.

Technical issues include:

- Key Interlocks may be very difficult to establish and keep up to date on practical systems
- Possible increased risk of accidents if maintenance personnel depend on interlocks rather than always testing and grounding or servicing the gear as electrically energized
- As errors can be made, equipment / insulation systems do fail, the only safe approach is to either treat all conductors as energized or they must be verified to be deenergized then adequately grounded.
- Consistency of new and old equipment

Therefore, this letter formally refers this discussion to the Switchgear Assemblies Subcommittee, for appropriate consideration at the next revision of the C37.20.3 document.

Regards,

P. W. Dwyer
Chair, C37.59 Working Group

Cc: T. W. Olsen
Secretary, Switchgear Assemblies Subcommittee

Attachment 1: Pertinent comments from C37.59 D21 ballot & W.G Response:

Comments from C37.59 D21 Ballot
 Referred to Switchgear Assemblies Subcommittee
 For consideration at next revision of C37.20.3
 19-August-2002

Extracted from C37.59 D21 Comments Compilation dated 24-July-2002

Date 24-July-2002	Document C37.59 D21
----------------------	------------------------

Discusser's name	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (G=General/ T=Technical/ E=Editorial)	COMMENTS	Proposed change	OBSERVATIONS OF THE CHAIR on each comment submitted
G.R. Nourse	6.3a)	2	T	The addition of power fuses to switches in equipment not designed to have power fuses requires the addition of more interlocks than required in C37.20.3 to ensure safe operation. C37.20.3 only requires interlocks to prevent fuse access when the switch is open. What happens when fuses are added to a tie switch, or a switch that could otherwise be backfed? Key interlocking (or some other type of interlock) needs to be required so that all possible power sources are removed, otherwise safe operation cannot be guaranteed. This is additional interlocking above what would have been required in the original design.	Change 2nd paragraph to: Addition of power fuses to equipment not designed to have power fuses requires the addition of interlocks to conform to C37.20.3. These interlocks prevent access to the power fuses unless the switch is open, and shall prevent closing the switch when the power fuses are accessible. In addition, consideration shall be given to the danger of power backfeeds to the power fuse compartment. All power sources shall be key interlocked to prevent fuse access unless all possible power sources are locked in the open position.	Backfeed risks are certainly a potential and existing hazard, for instance in multiple source installations. However, the working group does not feel that additional interlocks can be required if not required on new products and existing ones in the field. In reality it is very risky to do anything other than deenergize, test and ground if changing fuses or anything near the primary voltage. Devices fail, people drop tools, etc and the flashover risk in close fitting installations is too high. Additional warnings / labels would potentially do more harm as they are not on exiting gear.

Discusser's name	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (G=General/ T=Technical/ E=Editorial)	COMMENTS	Proposed change	OBSERVATIONS OF THE CHAIR on each comment submitted
G.R. Nourse	A.6			<p>A.6. We are thinking that the checklists are incomplete in the areas of key interlocking and the addition of fuses to switches. Identification of key interlocks and key numbers are often a task. It would be helpful under "typical Information to be provided by Customer/User to the converter" to add "Existing Key Interlocks: Manufacturer_____, SO# shown on interlock nameplate_____, Item # shown on interlock nameplate, key cylinder number(s)_____."</p> <p>Also under "Modification to be Performed" add some version of "Add key interlocks to breakers, switches, or compartment doors. Describe_____."</p> <p>At least this might be a trigger to get people thinking about what would be required.</p> <p>On the other hand, this might be too detailed. It should be a WG decision and I didn't want to muddy things further by bringing this up formally.</p>	Future consideration	Future consideration

Attachment 2: Sequence of E-Mails among C37.59 members while formulating the above position for C37.59.

Note, E-Mails have been edited to delete material not pertinent to the C37.59 / C37.20.3 issues.

-----Original Message-----

From: Pete W Dwyer [<mailto:pete.dwyer@ieee.org>]
Sent: Saturday, July 20, 2002 2:21 PM
To: Olsen, Ted
Subject: Geo Nourse comments

Ted:
George gave as comments on 6.3a)

G.R. Nourse 6.3a) 2 T

The addition of power fuses to switches in equipment not designed to have power fuses requires the addition of more interlocks than required in C37.20.3 to ensure safe operation. C37.20.3 only requires interlocks to prevent fuse access when the switch is open. What happens when fuses are added to a tie switch, or a switch that could otherwise be backfed? Key interlocking (or some other type of interlock) needs to be required so that all possible power sources are removed, otherwise safe operation cannot be guaranteed. This is additional interlocking above what would have been required in the original design.

He suggested the change:

Change 2nd paragraph to: Addition of power fuses to equipment not designed to have power fuses requires the addition of interlocks to conform to C37.20.3. These interlocks prevent access to the power fuses unless the switch is open, and shall prevent closing the switch when the power fuses are accessible. In addition, consideration shall be given to the danger of power backfeeds to the power fuse compartment. All power sources shall be key interlocked to prevent fuse access unless all possible power sources are locked in the open position.

Ted: I am aware of backfeed accidents and it certainly is an important caution for people working on gear - particularly with multiple sources. I think the issue is where should it be covered? Key lockouts certainly would be desirable, same with grounding, etc., but should we try to include it?

For easy reference, I provide our text from D21:

6.3 Interrupter switchgear fuse conversions

Possible conversions of metal-enclosed interrupter switchgear include addition of fuses to equipment not originally designed to have power fuses, and substitution of power fuses of a different type or rating than the equipment was designed for. Either type of conversion requires design verification.

- a) Conversion to add power fuses to metal-enclosed interrupter switchgear which was not designed with power fuses requires design verification in accordance with ANSI/IEEE C37.20.3 and ANSI C37.58. If previous design test data is not available for the converted configuration, additional design tests shall be made on the complete conversion and shall include dielectric withstand, continuous current, short-circuit current-carrying, momentary current, and short-time current tests. For current-limiting type power fuses, the short-circuit current tests shall be performed with designated power fuses with the maximum let-through current not exceeding the capability of the

switch. For expulsion type power fuses, short-circuit current tests to verify that the operation of the fuse in the enclosure does not adversely affect the mechanical and dielectric integrity of the enclosure are required unless test data from previous tests on an equivalent configuration is available.

Addition of power fuses to equipment not designed to have power fuses requires the addition of interlocks to conform to ANSI/IEEE C37.20.3. These interlocks prevent access to the power fuses unless the switch is open, and shall prevent closing the switch when the power fuses are accessible.

- b) Conversion to substitute a different design of power fuses other than with which the equipment was designed, requires design verification in accordance with ANSI/IEEE C37.20.3, and ANSI C37.58. If previous design test data is not available for the converted configuration, additional design tests shall be made on the complete conversion and shall include dielectric withstand and short-circuit current tests. For current-limiting type power fuses, the short-circuit current tests shall be performed with designated power fuses with the maximum let-through current for use with the switch. For expulsion type power fuses, short-circuit current tests to verify that the operation of the fuse in the enclosure does not adversely affect the mechanical and dielectric integrity of the enclosure are required unless test data from previous tests on an equivalent configuration are available.

Pete

-----Original Message-----

From: George Nourse [mailto:gnourse@chempower.com]
Sent: Monday, August 05, 2002 2:30 PM
To: Pete W Dwyer
Cc: Ted Olsen
Subject: C37.59D21 concerning switchgear conversions

Pete,

Sorry, I don't know what happened here. I did not see your email until today, on Monday afternoon. For some reason it apparently was delayed somewhere and was received after others sent or received on Friday. If mine was the only negative, your recirculation ballot passed anyhow, and hopefully you have already just forwarded the document RevCom with my standing negative. I don't really want to hold up the document to fix this, but I don't agree with the WG resolution as far as taking this lightly. Two companies that I am working with have been recently sued over just this, as a result of injuries on two separate projects. If one can add the fuse and change the original design, then one can take the necessary steps to add interlocks, or at least fuse barriers and signs. One normally expects that when fuses are accessible, that they are de-energized and can be safely changed. Just requiring the interlocks in C37.20.3 is insufficient, but perhaps the problem is with C37.20.3 and not C37.59. So in that respect, I am happy if Switchgear Assemblies addresses this issue and rules, but my thought is that the problem is with C37.59. It was C37.59 that allowed the addition of the fuses, thus changing the original design where there was not necessarily a problem.

As long as this gets on the agenda, and realizing the reality of this, I will change the negative to a positive vote.

Again, sorry for taking so long in responding.
Thanks,
George Nourse

From: Pete W Dwyer [pete.dwyer@ieee.org]
Sent: Monday, August 05, 2002 9:01 PM
To: George Nourse
Cc: Ward E Laubach; Ted Olsen
Subject: RE: C37.59D21 concerning switchgear conversions

George:

Thanks for the changing the negative to a positive.

I will commit to forwarding your specific concern and comment to the Switchgear Assemblies Subcommittee and further discussing this with the working group for the carry on of this work. I don't believe any accident factor can be taken lightly and I am aware of accidents involving backfeeds from two source switch and fuses. If you would like to elaborate any on your comment in writing, I will present the whole package at the next switchgear assemblies meeting in Galveston this fall. As I have said as a personal opinion, any close proximity service of medium voltage without testing and adequate grounding is very hazardous. NEMA is in process of preparing a safety document which emphasizes this also.

Pete

From: Olsen, Ted [ted.olsen@siemens.com]
Sent: Monday, July 22, 2002 7:46 AM
To: 'Pete W Dwyer'
Subject: C37.59: Geo Nourse comments

Now I understand your continuing responses. I screwed up in my response to George's suggestion. You know what they say about jumping to conclusions....

I agree that we cannot require interlocks, key type or otherwise, for this situation. C37.20.3 does not require them, nor does the C37.7X series of standards for padmounted switches, nor does the C37.3X series of standards for air switches. Key interlocks are probably impractical anyway, particularly if the device you need to interlock with is owned by another firm and is miles away. If we required such interlocks for a tie switch, why wouldn't we require them for a main switch? What about the thousands of installations of a lineup of switches with no main switch? The power source may be (and often is) the primary device ahead of the transformer. If we required interlocks and the source equipment was existing, who would be responsible? These kinds of thoughts are why the standards don't require interlocks now, and we can't require them either.

Therefore, I recommend that we not make the change that George suggested (or the modification in my July 20 message).

Ted

-----Original Message-----

From: Pete W Dwyer [<mailto:pete.dwyer@ieee.org>]
Sent: Sunday, July 21, 2002 12:30 PM
To: Olsen, Ted
Subject: C37.59: Geo Nourse comments

I tend to agree that more elaboration is needed on backfeed risks although I do struggle a little with a requirement for key interlocks if they are not required now. Are key interlocks specified anywhere now in the standards?

I would feel that possibly a label indicating the potential risk should be considered, particularly if you believe fuses are changed hot.

If we make any changes like this probably will require another recirculation ballot if the W/G agrees wont it?

Pete

-----Original Message-----

From: Olsen, Ted [<mailto:Ted.Olsen@ptd.siemens.com>]
Sent: Saturday, July 20, 2002 2:35 PM
To: 'Pete W Dwyer'
Subject: C37.59: Geo Nourse comments

I agree with George's intent, but not to the extent of making it a requirement. His wording says "consideration shall be given", which I would change to "consideration should be given".

If this is a real issue, it should be in C37.20.3, the 'parent' document with respect to switches. Moreover, it is not terribly uncommon for users to require insulated hot stick fuse handling tools as an accessory for load interrupter switch units. I've seen countless applications in which the fuses could be handled while the load side terminals are hot. In fact, I would imagine that this is fairly common on utility distribution systems where the load side feeder loops out and winds up an another substation a few miles away. With sectionalizers out on the system, I would imagine that the common practice is for the fuses to interrupt the fault, the linemen locate the fault, isolate the offending load, and re-energize from one end of the loop. Then, they go to the other end and replace the fuses while the load side of the fuses is hot.

My point is that we know it that this is done, and we can't 'legislate' against it. Therefore, we should recommend rather than require.

Ted

From: Pete W Dwyer [pete.dwyer@ieee.org]
Sent: Monday, August 05, 2002 9:01 PM
To: George Nourse
Cc: Ward E Laubach; Ted Olsen
Subject: C37.59D21 concerning switchgear conversions

George:
Thanks for the changing the negative to a positive.

I will commit to forwarding your specific concern and comment to the Switchgear Assemblies Subcommittee and further discussing this with the working group for the carry on of this work. I don't believe any accident factor can be taken lightly and I am aware of accidents involving backfeeds from two source switch and fuses. If you would like to elaborate any on your comment in writing, I will present the whole package at the next switchgear assemblies meeting in Galveston this fall. As I have said as a personal opinion, any close proximity service of medium voltage without testing and adequate grounding is very hazardous. NEMA is in process of preparing a safety document which emphasizes this also.

Pete