Canadian Standards Association
Mississauga, Ontario
To the Part I Committee

Subject No. 3136 Chair: V.G. Rowe Date: November 10, 2003

Title: Tightness of Joints, Rules 18-106(3) and J18-104(3)

Submitted by: Ted Olechna of Electrical Safety Authority on August 13, 2003.

Proposal: Add the requirements to have the treads made tight as a new Subrule 18-106(3)(d)

18-106 Wiring Methods, Class I, Zone 1 (see Appendix B)

(3) Threaded joints that are required to be explosion- proof or flameproof shall be permitted to be either tapered or straight, and shall comply with the following:

(a) Tapered threads shall have at least five fully engaged threads, and running threads shall not be used; and

(b) Where straight threads are used in Groups IIA and IIB atmospheres, they shall have at least five fully engaged threads; and

(c) Where straight threads are used in Groups IIC atmospheres, they shall have at least eight fully engaged threads; and

(d) the threads shall be made tight

Reasons for Request:

The issue is, when installing conduit into a HazLoc fitting, it is normally desirable to screw the fitting all the way in until they stop turning.

However, because of offsets, 90 degree bends ect, it may be impossible to properly orientate a box when the conduit is "tight" , usual field practice process is to tighten the conduit, then back it off to the nearest orientation point while maintaining the "fully engaged threads" requirement.

An investigation was started by the Electrical Safety Authority, and what we found out was that the code was not specific on the issue if the joint had to be tight, just so the specified threads were engaged. ESA contacted the Canadian Explosion Research Council and presented the issue. and here are excerpts of their reply

"It has always been the assumption that these joints would be tight when there were "at least five fully engaged threads". The point the Rule is trying to make is that under some circumstances it is

possible to get a tight joint with less than 5 fully engaged threads. This might be because the conduit or the enclosure didn't receive enough turns of the threading tool. This 5 thread thing has been around for a long time and I do not know if there is actually any research to back up that number; maybe less than 5 threads would be found to be OK if some one did some research; but since no one to my knowledge has done so, my guess is that the number 5 was picked out of the air a long time ago as it was felt to be reasonably safe. Maybe that number was chosen to take into account the fact that that the joint wouldn't be fully tight all the time taking into account the conditions you described, but who knows if that was taken into consideration. In any event, experience has shown this guesstimate turned out to be valid, we don't have any incidents that I know of caused by slack conduit joints.

When products undergo certification testing for hazardous locations, the unit under test is attached to various lengths of conduit to simulate a variety of actual installations with conduit. In all these situations it's routine to make the conduit tight. Accordingly in the lab testing environment it's pretty much unheard of to have this conduit joint be the cause of any failure in explosion testing, so we can say with a high degree of certainty that a tight taper-to-taper joint is quite effective.

I completely see your point that the conduit will not be quite tight when in its final position due to the conduit bends.

To my knowledge there has never been any research done to investigate just how slack a joint would have to be before it would allow an internal explosion to propagate to a surrounding explosive atmosphere. "

ESA has also contacted the manufacturer and this was the comment
"These units are used as junction boxes with no electrical controls and this may be a grey area of the Code (after 5-threads engagement how tight must the connector be?).

In conclusion, the Code should include the word " the treads shall be made tight " based on the facts above, that as long as the appropriate number of threads were fully engaged, and made tight, in the fitting (i.e. fully contact) then this would remove the grey matter

The same consideration should be made in Appendix J18-104(3)

Chair's Comments: I have discussed this subject with the submitter and an electrician who works in the oilpatch. Based on those discussions we came to the conclusion that the proposal as written could make it difficult or in some cases impossible to install some fittings without backing off part of a turn. In consultations with the submitter we have agreed on the following wording for an explanatory Appendix B item to replace the original submission:

18-106(3)(a)
18-156(3)(a)
Where tapered threads are used, the requirement to have five fully engaged threads (i.e. threads done up tight) is critical for three reasons:

1. When the threads are not fully engaged, the flame path is compromised making it possible that an explosion occurring within the conduit system could be transmitted to the area outside the conduit, and

2. If there are not five fully engaged threads the flame path may be too short to cool the gases resulting from an internal explosion to a temperature below that which could ignite gas in the surrounding area, and
3. As the conduit forms a bonding path to ground, not making the conduit tight will introduce resistance into the flame path and if a fault occurs may result in arcing at the interface.

While it may not always be possible to install certain fittings without backing off, it is important to ensure the connection is as tight as possible. Properly made conduit connections are critical to the safety of Hazardous Location wiring systems.

The note should also be added to Appendix JB for Rules J18-104(3).

Subcommittee Deliberations: There were seven ballots received, all agreeing with the modified proposal to add a Note to Appendix B.

Subcommittee Recommendation: Accept the proposal under Chair's Comments (which was agreed to by the Submittor).