

**From:** [Paul Harrington](#)  
**To:** [Bennett, Gilbert](#); [JohnMacIsaac@nalcoreenergy.com](mailto:JohnMacIsaac@nalcoreenergy.com)  
**Subject:** Fwd: HVdc conductor - Bulging strands  
**Date:** Thursday, June 9, 2016 9:36:31 AM

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FYI

Sent from my iPhone

Begin forwarded message:

**From:** "Nik Argirov" <[nik@argirovglobal.com](mailto:nik@argirovglobal.com)>  
**Date:** June 9, 2016 at 8:12:49 AM NDT  
**To:** "Paul Harrington" <[pharrington@lowerchurchillproject.ca](mailto:pharrington@lowerchurchillproject.ca)>, <[JasonKean@lowerchurchillproject.ca](mailto:JasonKean@lowerchurchillproject.ca)>, <[StevePellerin@lowerchurchillproject.ca](mailto:StevePellerin@lowerchurchillproject.ca)>  
**Subject:** FW: HVdc conductor - Bulging strands

FYI

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**From:** Hamdy Khalil [<mailto:hamdy@hkpowerline.ca>]  
**Sent:** Thursday, June 9, 2016 12:31 AM  
**To:** 'Nik Argirov' <[nik@argirovglobal.com](mailto:nik@argirovglobal.com)>  
**Subject:** RE: HVdc conductor - Bulging strands

Nik,

It is hard to tell if it is a factory issue or installation issue. If it is only one reel we have issue with or we have issue with the "unstring" conductor on the reel then it would be factory issues. However, if there are multiple reels and the issue only occur with the strung conductor, then it is mostly installation issue.

Factory issues mainly occurs if they did not strand each layer at the same temperatures. Another possibility is that one of the aluminum reels used in the stranding was still warm from the drawing process. It's also possible the manufacturer failed to follow the requirement that each aluminum layer must have a lay ratio less than the layer under it. Or maybe they didn't stay within the required lay ratio minimums and maximums during manufacturing. All this could be difficult to prove if there was poor quality control and oversight.

Installation issues during stringing: they may have used too small a sheave, or perhaps put too much bending when entering and leaving the sheaves. For large conductors, it is often necessary to use multiple sheaves to help alleviate the stress at the sheave.

Any of these may well have stretched or deformed the outer layer as the conductor passed through the sheaves.

From reading the emails, it seems the issue only associated with the strung wire and multiple reels which lead to mostly installation issue rather than factory issue.

As for remediation, it is possible that after one or two significant ice loadings, or after a number of years, the permanent elongation (creep) will help to smooth out the conductor surface. Also, the ice loading and stretching the conductor would mostly help the conductor. Also, I would not expect having Corona issues.

The main concern could be flash over between the two phases (unraveled conductor to the other phase). The other concern would be about the fact that clamps are putting very high wear and stress on the proud strands. That may be difficult to fix now. In some conductor damage cases, utilities used to install armor rod under the damper. However, in our case here it would be very difficult to find a damper size that fits over the conductor plus the armor rod, I do not think it is practical.

I also asked a colleague who is retired now but he is subject matter expert for the conductors and hardware and he used to be the Manager of the Asset Management team at BCH for years, he mentioned that:  
“Back in the “old days”, field crews used what they called “wood wrenching” to work out a popped strand due to too much stress at the sheaves. Basically, it is a hardwood device with a conductor diameter sized hole in the middle, and two handles that you attach to the conductor. You slowly wind the wrench down the length of the anomalies, turning in the direction of the strands as you progress. I haven’t heard of anyone trying to use it on a conductor this size though. “

We can discuss in more details over the phone.

Regards,

Hamdy  
604-██████-101

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**From:** Nik Argirov [<mailto:nik@argirovglobal.com>]

**Sent:** Wednesday, June 8, 2016 8:59 PM

**To:** 'Hk Power line' <[hamdy@hkpowerline.ca](mailto:hamdy@hkpowerline.ca)>

**Subject:** FW: HVdc conductor - Bulging strands

FYI

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**From:** [JasonKean@lowerchurchillproject.ca](mailto:JasonKean@lowerchurchillproject.ca)  
[<mailto:JasonKean@lowerchurchillproject.ca>]

**Sent:** Wednesday, June 8, 2016 6:27 PM

**To:** Nik Argirov <[nik@argirovglobal.com](mailto:nik@argirovglobal.com)>

**Cc:** [StevePellerin@lowerchurchillproject.ca](mailto:StevePellerin@lowerchurchillproject.ca); [PHarrington@lowerchurchillproject.ca](mailto:PHarrington@lowerchurchillproject.ca);

[JasonKean@lowerchurchillproject.ca](mailto:JasonKean@lowerchurchillproject.ca); [KumarKandaswamy@lowerchurchillproject.ca](mailto:KumarKandaswamy@lowerchurchillproject.ca)

**Subject:** Re: HVdc conductor - Bulging strands

Nik,  
Only after wire pulling. I can call you on Friday to provide a detailed briefing on the subject.

Jason

Jason R. Kean, P. Eng., MBA, PMP  
Deputy General PM - LCP  
Consultant to LCMC  
Ph. (709) 727-9129

On Jun 8, 2016, at 5:07 PM, Nik Argirov <[nik@argirovglobal.com](mailto:nik@argirovglobal.com)> wrote:

Steve,  
Was the issue noticed on any of the reels on the ground or this only happened after pulling the wire up?

Regards,  
Nik

**From:** [StevePellerin@lowerchurchillproject.ca](mailto:StevePellerin@lowerchurchillproject.ca)  
[<mailto:StevePellerin@lowerchurchillproject.ca>]

**Sent:** Wednesday, June 8, 2016 1:26 PM

**To:** Nik Argirov ([nik@argirovglobal.com](mailto:nik@argirovglobal.com)) <[nik@argirovglobal.com](mailto:nik@argirovglobal.com)>

**Cc:** [PHarrington@lowerchurchillproject.ca](mailto:PHarrington@lowerchurchillproject.ca);  
[JasonKean@lowerchurchillproject.ca](mailto:JasonKean@lowerchurchillproject.ca)

**Subject:**

Nik;

I am following up on your inquiries to Paul from earlier today - specifically:

1. **"Was there a sample taken from the conductor to be able to inspect the cross section at a bulging strand?"** Yes, there has been multiple field samples and partial reels taken from the field and inspections of the cross section conducted. On June 3rd a large quantity of field samples were sent to General Cable's facility in Quebec for testing. Observations of conductor behavior from the field have been recorded and passed along to the manufacturer. This includes the observation that once tension is removed from the conductor, the strand tends to settle back into position.
2. **"How many reels are affected?"** There are multiple reels affected by this popping strand. We are currently investigating the

conductors strung to date and noting where we are experiencing this issue. Our field team has generated an Observation Log noting areas of concern. However, this effort is not complete yet and therefore the log is not complete. This is a work-in-progress to inform the investigation.

Regarding your question - "***Also, can Nexans be approached and asked for an opinion as well?***" Can you please elaborate on a role for Nexan's here? Potential industry expert?

I fully expect we will have future exchanges on this subject. I hope the above is helpful for now.

**Stephen Pellerin**

**Special Projects & 3rd Party Coordination Manager**

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