Q. ***Re: Tab 4.4 - Rebuild Distribution Lines Update – Stainless Steel Pole Mounted Transformer Hanging Brackets***

Newfoundland Power outlines it had discussions with the manufacturer of the hanging brackets. Please provide all written correspondence between Newfoundland Power and the manufacturer regarding the hanging brackets.

A. Attachment A includes all email correspondence between Newfoundland Power and ABB, the manufacturer of the stainless steel pole mounted transformer.

Attachment B includes the metallurgical report titled Failure Analysis of a Transformer Bracket dated January 6, 2004.

Attachment C includes the minutes of the March 27, 2008 meeting between Newfoundland Power and ABB.

Attachment D includes the report titled Transformer Mounting Bracket Failures Analysis Report dated April 24, 2008.

Attachment E includes miscellaneous drawings and sketches exchanged between Newfoundland Power and ABB.

Email Correspondence
Between
Newfoundland Power and ABB

From: Rose, Clifton
To: francois.m.lessard@ca.abb.com
Date: 2003/07/16 14:09:38
Subject: Broken Transformer Bracket

Hi Francois,

The following is a message from our Port Aux Basques area and pictures of a broken lower transformer bracket. The transformer referred to below that fell from the pole in February was a Moloney transformer and we are awaiting their report on the incident. We have expressed concern on a number of occasions on the thickness of the stainless steel brackets. This again raises our concern.

To address our concerns, we would like to have the bracket analysed and a report completed.

Cliff

> -----Original Message-----
>From: Green, Wayne
>Sent: July 15, 2003 4:17 PM
>To: Rose, Clifton
>Subject:
>
>Cliff:
>
>The pictures attached are of a stainless steel transformer that was installed in February 2003. This unit was installed in the same location were the other transformer fell from the pole in February 2003. The transformer was removed from the pole July 15/03 and stored at the Port Aux Basques storage yard.
>
>* Transformer type: ABB
>* Transformer size: 50 KVA
>* Manf. date: Nov. 2002
>* Weight: 330 KG.
>
>Any questions give me @ 4803.
>
>Wayne

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2003/07/17 10:26:48
Subject: Broken transformer bracket

Good morning sir,

We have logged a complaint in our CCRP system (#17616)
I'll be responsible for that complaint.. Analysis investigation and a complete report will be done.

Your return number: RP91
Please ship back the transformer to my attention.

Could you give me all the information regarding that unit:

- Serial number
- Kva
- Voltage

Best regards,

Alain Tremblay

From: "Rose, Clifton"
To: francois.m.lessard@ca.abb.com; pierre.a.rancourt@ca.abb.com; evelyne.m.harvey@ca.abb.com
Date: 2003/08/08 14:11:42
Subject: FW: Broken transformer bracket

The following message is being resent. It was sent to you but was not delivered due to an incorrect address.

Cliff

-----Original Message-----
From: Rose, Clifton
Sent: August 8, 2003 2:02 PM
To: 'alain.r.tremblay@ca.abb.com'; Rose, Clifton
Cc: francois.m.lessard@caabb.mail.abb.com; pierre.a.rancourt; evelyne.m.harvey
Subject: RE: Broken transformer bracket

Alain,

Sorry for the delay in forwarding the information, I was unable to get the information before I went on vacation.

The following is a portion of the name plate info:

Company number: 2484293
Ser. number: 59711-0001
Oil: 70 litres
Mass: 330 KG

Cliff

From: evelyne.m.harvey@ca.abb.com
To: Rose, Clifton
Date: 2003/10/28 13:31:09
Subject: Re: FW: Broken transformer bracket
Attachments: pic09961.pcx

Hi

Please advise when you will be shipping this transfomer, as we never received it (RP-91).

Best Regards
Evelyne

From: jean-marc.m.demers@ca.abb.com
To: "Rose, Clifton"
Date: 2004/01/08 16:12:42
Subject: Report
Attachments: XX-03002-98 Rapport XPERX.pdf

Rose,

Please find attached the technical report on the broken transformer support (See attached file: XX-03002-98 Rapport XPERX.pdf)

Jean-Marc M Demers
Regional Sales Manager, Quebec & Atlantic Provinces
ABB Inc.
PTMV / Sales & Marketing

8585 Trans-Canada Highway
CA H4S 1Z6 Saint-Laurent

Phone: +1 514 856 6215
Fax: +1 514 856 6298
Mobile: +1 514 237 8718
email: jean-marc.m.demers@ca.abb.com

From: "Rose, Clifton"
To: joanne.j.gosselin@ca.abb.com
Date: 2004/04/26 16:27:12
Subject: RE: Complaint with ABB

Good Morning,

Newfoundland Power (NP) is not satisfied with the report's recommendations. Transformers have normally been mounted without the use of additional washers without similar problems. NP has questioned the strength/thickness of the bracket on previous occasions and have been told that the strength is sufficient for the application. Will a washer be required on all installations?

For the bolt holding the bracket, the report also recommends that "a maximum tightening torque should be proposed by design engineers to avoid over stressing the part". Will ABB be recommending this torque value?

Cliff Rose

-----Original Message-----
From: joanne.j.gosselin@ca.abb.com
Sent: April 12, 2004 12:45 PM
To: crose@newfoundlandpower.com
Subject: Complaint with ABB

Good morning ,

you made a complaint about brocken hanger bracket on transformer last july. Alain Tremblay has send you a report about some analysis. We want to know if you are satisfy the way ABB resolved the problem.

Thank you very much.

Joanne Gosselin

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2004/04/30 12:13:21
Subject: RE: Complaint with ABB

Good morning Mr Rose,

Given mechanical properties of stainless steel and mild steel are different both materials do not react the same way under stress. The strength yield value for mild steel is 40% higher than stainless steel. So in general with stainless steel, cracks are more subject to be initiated especially in that specific case when the bracket does not fit exactly the pole shape. The risk would always be there even using a thicker material.

The report recommends the use of a washer and a maximum torque to avoid damage at the bracket for those specific cases (when bracket does not fit exactly the pole shape). But given it is not obvious to catch all cases this process would allow you to cover 100% such case.

ABB will recommend a maximum torque value in next few weeks. We are working with our supplier doing some tests to determine what will be that maximum torque value.

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 450-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2004/06/10 11:00:28
Subject: RE: Complaint with ABB

Good morning Mr Rose,

The torque value for the bolt shall not exceed 55 foot/pound
We also recommend to use a 2" outside diameter flat washer.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 450-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: luc.f.coulombe@ca.abb.com
To: "Rose, Clifton"
Date: 2004/10/01 13:05:18
Subject: June 2nd, 2004 NP - ABB Meeting : Follow up

Cliff

About the brocken hanger bracket problem we have had last January, we don't consider at this point that a thicker hanger bracket is necessary nor a third bracket. We base our assumption on the conclusion of the report prepared by a independant metallurgical firm and by the fact that over the last 4 years, we shipped over 15000 stainless steel units to many customers without any hanger bracket problem reported to us.

However, we do recommend the use of a washer as well as a maximum tightening torque as Alain Tremblay (mechanical designer) explained on his e-mail dated April 30 :

Given mechanical properties of stainless steel and mild steel are different both materials do not react the same way under stress. The strength yield value for mild steel is 40% higher than stainless steel. So in general with stainles steel, cracks are more subject to be initiated especially in that specific case when the bracket does not fit exactly the pole shape. The risk would always be there even using a thicker material.

The report recommends the use of a washer and a maximum torque to avoid damage at the bracket for those specific cases (when bracket does not fit exactly the pole shape). But given it is not obvious to catch all cases this process would allow you to cover 100% such case.

ABB will recommend a maximum torque value in next few weeks. We are working with our supplier doing some tests to determine what will be that maximum torque value. Regarding the maximum torque value, Alain send the answer on his e-mail dated June 10 :
The torque value for the bolt shall not exceed 55 foot/pound. We also recommend to use a 2" outside diameter flat washer

Best regards,

Luc Coulombe, P. Eng.
Head of Department - Marketing / Distribution Transformers Division
Phone: +1 418 650 7635
Fax: +1 418 650 2021
email: luc.f.coulombe@ca.abb.com

From: "Rose, Clifton"
To: evelyne.m.harvey@ca.abb.com
Date: 2006/02/06 17:57:35
Subject: Failed Transformer Hanger Bracket

Good Day Evelyne,

We have a 50 kVA transformer that was manufactured in 06-2002 with a failed upper hanger bracket as shown in he attached pictures. The serial number of the unit is 49598-008. The lower bracket does have a crack, but did not fail to the same degree as the upper bracket. The transformer was installed in a pole in an area that is subjected to high winds. A crew working in the area discovered the condition and removed the transformer before total failure of the bracket.

Newfoundland Power has discussed this issue previously with ABB following complaints from field staff saying the brackets were flexing in the wind. A similar failure occurred in 2003 (complaint # 17616) where the thickness of the bracket was questioned. In that instance the lower bracket failed and it was recommended to use a washer where the bracket does not fit the pole exactly. The use of a washer on the upper bracket is not possible due to the design of the bracket. We need to develop a better solution. The existing bracket design in stainless steel has shown it will not withstand the wind loading in our environment. What alternatives are there to this ongoing problem?

Cliff

From: evelyne.m.harvey@ca.abb.com
To: "Rose, Clifton"
Date: 2006/02/08 11:52:16
Subject: Failed Transformer Hanger Bracket

Hi

Ref to RP-162

Please advise if the seal is broken, if yes please have the oil analysed for PCB and send me a letter confirming that th PCB is less than (<2PPM PCB).

Otherwise please make sure that the transformer is drained of it's oil.

The transformer will be sent back to St-John's.

Please confirm this is what will be done.

Thanks
Evelyne

----- Forwarded by Evelyne M Harvey/CATRM/ABB on 02/08/2006 09:03 AM -----

02/08/2006 08:45 AM
Alain R Tremblay/CATRM/ABB
Dept.: Engineering, Phone: +1 418 650 7660

To: crose@newfoundlandpower.com
cc: Luc F Coulombe, Evelyne M Harvey
Subject: Failed Transformer Hanger Bracket

Mr Rose,

Would you please return back the transformer in Quebec city plant for our investigation. The return number is RP-162 We have opened a complaint in our CCRP system. We will repair the unit (new tank) and we will provide you with new alternative (s) for this problem.

Best regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: evelyne.m.harvey@ca.abb.com
Date: 2006/02/08 12:10:42
Subject: RE: Failed Transformer Hanger Bracket

Hi Evelyne,

The seal is broken and I have asked for an oil sample to be analysed.

Cliff

From: "Rose, Clifton"
To: evelyne.m.harvey@ca.abb.com
Date: 2006/02/16 14:50:02
Subject: Failed Transformer Hanger Bracket
Attachments: ABB Broken Bracket.pdf

Good Day Evelyne,

Attached is the PCB oil test report for the transformer with the broken hanger bracket. We will proceed with the shipping of the transformer to ABB.

Thanks,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2006/03/30 14:34:56
Subject: RE: Failed Transformer Hanger Bracket RP-162,

Good morning Cliff,

We have changed the tank on this transformer with a new one.

Following our analysis we have dicided to supply thicker material for hanger bracket.

The material will be : SST 316L GAUGE 7 (0.17187") instead of SST 316L GAUGE 10 (0.14062")
Our proposal for next contract include this new thicker material.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2006/03/30 15:49:39
Subject: RE: Failed Transformer Hanger Bracket RP-162,

Cliff,

A little mistake in my previous e-mail. The material is SST 316L GAUGE 8

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: luc.f.coulombe@ca.abb.com
Date: 2007/10/23 10:11:01
Subject: FW: Transformer - Southern Hr.

Good Morning Luc,

Attached are a few pictures of a 50 kVA ABB transformer manufactured in 2002 and installed in our Southern Harbour area. The transformer fell from the pole this past weekend. We have had discussions on several occasions in the past on our concern with the thickness of the hanger brackets. In 2003 and 2006 we provided pictures and transformers with broken hanger brackets. Both of these were also 50 kVA units and the transformers were removed from the pole without incident. The latest incident this weekend and the potential for major injury to the general public as well as negative public relations has caused us great concern. It has raised questions as to the integrity of the brackets on transformers presently installed in the field to the point that we may have to identify and remove these units from service for fear of bracket failure in the future.

I would appreciate your comments on this issue and the design of the hanger brackets.

Regards,

Cliff

>From: Gullage, David >Sent: October 22, 2007 8:12 AM

>To: Doyle, Eugene; Hogan, Tom; Rose, Clifton
>Subject: Transformer - Southern Hr. >

>Here is the pictures of the transformer that fell out of the pole in Southern Hr.
>
>Manufactures date is May 2002.

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2007/10/23 13:05:14
Subject: Re: Fw: Transformer - Southern Hr.

Good morning Mr Rose,

We understand your concerns and we will take and manage very seriously that issue. Be sure we will solve that concern by providing Newfoundland Power with a recommendation or solution at your complete satisfaction.

Now the first step is to return back the unit with all damaged parts coming from the unit and the parts used for the installation on the pole (bolts, washers and hardware) for our analysis and investigation.

We will comme back to you as soon as possible.

Please ship back the unit and parts using #RP-216.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer PTTR / Ingénierie - Engineering

Tel / Phone: 418 650-7660
Fax: 418 650-2021
email: alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2007/11/08 13:02:48
Subject: Re: Fw: Transformer - Southern Hr.

Good morning Mr Rose,

I have a few question again.

We would like to have the pole diameter and pictures of the pole where the transformer was installed.

Did you installed a new transformer on this pole ?

Thanks,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 07/10/31 09:23 AM
Subject: Re: Fw: Transformer - Southern Hr.

Good morning Mr Rose,

In order to help us to have a better understanding of the problem I have a few questions regarding that issue.

* Is that unit has been installed in the same area as the previous ones in 2003 and 2006 ?

* Is there any particular atmospheric condition in that area ?

* Are you aware about any seismic activity in that area in last years or months ?

* Did the bolts have been torqued not to exceed 55 foot/pound ?

* What type of equipment do you use to torque the bolts ?

* Are you aware about any irregular shape on the pole, pole movement or something unusual ragarding that transformer installation ?

We need to have the maximum of details. If you have any relevant informations or feelings please let us know.

Best regards

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660 Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2007/11/14 16:41:59
Subject: RE: Fw: Transformer - Southern Hr.

Good morning Alain,

Sorry for the delay in responding to your questions. We had to visit the site to verify the information.

* Is that unit has been installed in the same area as the previous ones in 2003 and 2006 ?

The transformer was installed in a different area of the Province. The transformer from 2003 was installed on the West coast near Stephenville. The 2006 transformer was installed on the East coast on the Avalon Peninsula. This latest transformer was installed on the Eastern part of the Island near Clarenville. Three different geographic locations.
* Is there any particular atmospheric condition in that area ?

No particular atmospheric conditions in the area. As with all areas of the Province, it is exposed to salt contamination. It is also subjected to high winds from time to time.

* Are you aware about any seismic activity in that area in last years or months ?

We are not aware of any recent seismic activity in this area.
* Did the bolts have been torqued not to exceed 55 foot/pound ?

Transformer mounting bolts are not torqued with a torque wrench.

* What type of equipment do you use to torque the bolts ?

Bolts are not torqued.

* Are you aware about any irregular shape on the pole, pole movement or something unusual regarding that transformer installation ?

We are not aware of any irregular shape on the pole. The structure is an angle structure that is side guyed, however the guy was found to be a little slack at the time of the transformer falling. Thus there may have been movement of the pole.

* We would like to have the pole diameter and pictures of the pole where the transformer was installed.

Pictures showing the pole with the new replacement transformer are attached. The pole is a class 4, 40 foot pole. The circumference at the transformer location was measured at 27 inches.

* Did you installed a new transformer on this pole ?

A new transformer manufactured 03-2007 was installed.

Alain, this incident has caused us considerable concern as it is the third failure of ABB hanger brackets. While each failure involved a 50 kVA transformer manufactured in 2002, it does raise

questions of other transformers of different size and manufactured dates. We have many transformers installed throughout the Island that are subjected to similar environmental conditions and installed in the same manner without the use of torque wrenches. We have only one known failure of a mild steel bracket.

Cliff

From: alain.r.tremblay@ca.abb.com
To: Rose, Clifton
Sent: November 8, 2007 12:03 PM
Cc: luc.f.coulombe@ca.abb.com
Subject: Re: Fw: Transformer - Southern Hr.

Good morning Mr Rose,

I have a few question again.

We would like to have the pole diameter and pictures of the pole where the transformer was installed. Did you installed a new transformer on this pole ?

Thanks,
Alain Tremblay Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 07/11/15 03:17 PM
Subject: Transformer - Southern Hr.

Thanks Alain,

The question that arose on the smaller size transformers was; Will the same problem exist, but merely take longer to manifest due to the smaller size and weight? We look forward to your report on this issue.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: Rose, Clifton
Cc: luc.f.coulombe@ca.abb.com
Sent: November 15, 2007 4:20 PM
Subject: Transformer - Southern Hr.

Good afternoon Cliff,

Thank you for your responses to my questions.

We understand your concern about this problem and we want to have a complete resolution on that issue. That's why we have requested an external engineering firm to get an independant expert evaluation and thorough examination. We are working very hard and we expect to have a conclusion as soon as possible.

The other transformers of different size doesn't raise concern to us because the weight of 25 Kva is around 150 Kg less than 50 Kva and the tank is smaller. Regarding the 75, 100 and 167 kva those units have a 1/4" bracket thickness. We don't expect to have any failure with those units.

Thanks again for your cooperation on that issue.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2007/11/15 17:47:28
Subject: RE: Fw: Transformer - Southern Hr.

Thanks Alain,

The question that arose on the smaller size transformers was; Will the same problem exist, but merely take longer to manifest due to the smaller size and weight? We look forward to your report on this issue.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: Rose, Clifton
cc: luc.f.coulombe@ca.abb.com
Sent: November 15, 2007 4:20 PM
Subject: RE: Fw: Transformer - Southern Hr.

Good afternoon Cliff,

Thank you for your responses to my questions.

We understand your concern about this problem and we want to have a complete resolution on that issue. That's why we have requested an external engineering firm to get an independant expert evaluation and thorough examination. We are working very hard and we expect to have a conclusion as soon as possible.

The other transformers of different size doesn't raise concern to us because the weight of 25 Kva is around 150 Kg less than 50 Kva and the tank is smaller. Regarding the 75, 100 and 167 kva those units have a 1/4" bracket thickness. We don't expect to have any failure with those units.

Thanks again for your cooperation on that issue.
Best regards,
Alain Tremblay

Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email: alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2007/11/20 17:55:54
Subject: RE: Fw: Transformer - Southern Hr.

Cliff,

Please send a bolt and nut and if you use washers send washers also to my attention

Address:
ABB Inc.
500 du Binome
Quebec Qc.
G1P 4P1

Thanks,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660

Fax: 418 650-2021
email: alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Cc: Luc F Coulombe
Date: 07/11/20 03:18 PM
Subject: Transformer - Southern Hr.

Hello Alain,

The following is in response to your latest questions:

* When I said the bolts are not torqued, I mean that a torque measuring tool is not used to tighten the nut. Therefore, we do not know the value of torque that is applied to the nut during installation.

* In the past, the nut was tightened using hand wrenches, an adjustable wrench or ratchet type wrench. Recently, impact tools are being used to tighten the nuts. We do not know for certain if an impact tool was used in this case, however, we suspect that given the timeframe, a hand tool was used. It is possible that there could have been a little slack in either the top or bottom bolts, however we feel that this was most likely not the case and the nut was tight. However, it is an unknown.

* We use 3/4 inch galvanized bolts for transformer installations. The bolts would have been reused to install the replacement transformer. The bolts are as per CSA Standard C83.23-96 except with square head and nut. I could have one sent to you if you wish.

* The procedure followed in installing the transformers is:
    * Bolts are installed in pole with the nut backed off to expose the bolt head from the pole.
    * The transformer is placed in position on the bolts.
    * The nuts are tightened to bring the transformer brackets into the pole.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: Rose, Clifton
Cc: luc.f.coulombe@ca.abb.com
Sent: November 20, 2007 10:36 AM
Subject: Transformer - Southern Hr.

Good morning Cliff,

At this stage of our investigation that is our hypothesis. For now we know the 50 Kva is the worst case because of the weight. As you know we delivered similar design to another customer without any failure. We made the vertical and horizontal load testing requested by the CSA specification using almost twice the loading requested in the spec and the results were well lower than the maximum bracket displacement allowed by the spec. Nothing lead us to have any

concerns for smaller size and weight untill we have identified why those failures occurred.

The results of the loading tests showed us that the bracket design and material bracket is suitable when the transformer is used in normal condition. In that specific failure case we would like to know what applied abnormal stress on the bracket. That's why I would have some other questions for you.

* When you say bolts are not torqued. Do you have an approximate torque on the bolts ? What are the rules or precudure that must be followed by the linemen ?

* Is it manually tightened using a wrench ? Is there a possibility to have a little slack on the top bracket when thetransformer was installed ?

* What kind of hardware do you use for installation ? Since you did not shipped the hardware used with the transformer could you send a bolt, nut and any installation hardware that you use for installation to my attention ?

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: crose@newfoundlandpower.com
Cc: Luc F Coulombe/CATRM/ABB@ABB_CAABB
Subject: Transformer - Southern Hr. Link

Good morning Mr Rose,

We understand your concerns and we will take and manage very seriously that issue. Be sure we will solve that concern by providing Newfoundland Power with a recommendation or solution at your complete satisfaction.

Now the first step is to return back the unit with all damaged parts coming from the unit and the parts used for the installation on the pole (bolts, washers and hardware) for our analysis and investigation.

We will comme back to you as soon as possible.

Please ship back the unit and parts using #RP-216.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering

Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2007/11/27 11:41:14
Subject: Fw: Transformer - Southern Hr.

Good morning Cliff,

I received the installation harware. Thank you.
The investigation is currently on the way.
We hope to have results of this investigation by the week of December 17th.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/01/23 18:10:30
Subject: Transformer - Southern HR - RP 216

Good afternoon Cliff,

In regards to that complaint we have now in hands the investigation results. As preliminary results I can say the following:

The thickness of the material is appropriate by calculation and computer simulation. Moreover the vertical and horizontal bracket tests requested by CSA C2.2 spec have been done on four (4) tanks identical to the defective tank. Three (3) tanks were tested in an independant laboratory according to CSA C2.2

Another tank were tested at our supplier facilities using 150% of the requested loading in the spec. All tests were passed successfully. Other investigation as metallographic and microfractographic analysis have been performed in a metallurgic laboratory.

In summary our analysis showed us that a combination of factors may have led to the failure

However to finalize our investigation I need to have another installation hardware to perform a final test. Could you send a transformer installation bolt, nut and washer to my attention ? See the adress below.

ABB Inc.
500 du Binome
Quebec Qc.
G1P 4P1

Following this test Pierre Andre Rancourt and Jean Massé from the external engineering firm plan to go to Newfoundland to meet with you for results explanations. If possible they would like to take a look at some transformers in the field.

Please confirm the shipment of the hardware.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/02/25 13:05:25
Subject: FW: picts

Good Morning Alain,

Below is a message received this morning from our St. John's area office notifying me of a failure of hanger brackets on a 50 kVA transformer. Based on the pictures, it appears that this may be a similar failure to the Southern Harbour failure. I am expecting more information and will advise you of any further details.

Regards,

Cliff

>
>From: Feehan, Peter J.
>Sent: February 25, 2008 11:25 AM
>To: Greenslade, Doug; Troke, Trina; Rose, Clifton
>Subject: FW: picts
>Trina & Cliff,

>The following transformer was removed from Old Penneywell Road last week. Crew was sent there to upgrade the transformer from a 50 to a 75 a when they noticed the stainless steel transformer moving side to side in the pole. They thought the bolts were loose on the transformer but on inspection found that the transformer was swaying back and forth on the bracket. Defective material report is pending. Manufacture date was March of 2003.

The transformer is being held in stores pending inspection by Distribution Standards.

>From: Greenslade, Doug
>Sent: Monday, February 25, 2008 9:12 AM
>To: Feehan, Peter J. >Subject: picts


From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/02/28 11:47:17
Subject: RE: Fw: Transformer - Southern Hr.

Good Morning Alain,

Would you please forward me the serial number of the 50 kVA transformer returned to you from Southern Harbour. Our company number was 2477164.

Thanks,

Cliff

From: "Rose, Clifton
To: alain.r.tremblay@ca.abb.com
Date: 2008/03/05 11:06:03
Subject: RE: FW: picts

Good morning Alain,

We will advise on the time and date suggested for the meeting.
I do not have any additional information on the latest failure.

Will you be providing a written report for our perusal prior to our meeting to discuss the issue?
Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/03/05 10:47:46
Subject: Re: FW: picts

Good morning Cliff,

We are planning to meet with you in Newfoundland about this issue on March 20th.
Is it possible early in the morning ? Please let me know so that we can make the necessary arrangements.

About the failure below. Do you have any further informations ?

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/03/05 14:11:18
Subject: RE: FW: picts

Hi Alain,

Would it be possible to have our meeting next week? We have people who will be on vacation during the week of March 17 to 21.

Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/03/06 10:29:26
Subject: Meeting Newfoundland Power - ABB

Hi Cliff,

Unfortunately some of us are not available next week.
We are looking for March 27th early in the morning.
Would it be possible this date ?

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660

Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/03/07 12:37:26
Subject: Confirmation for Meeting Newfoundland Power - ABB

Good morning Cliff,

We are going to book seats on a flight for meeting on March 27th because we have some problems to book for March 20th.

We would like to have our meeting early in the morning because we will have our flight for return to Quebec probably in the afternoon. I will inform you of the time of the flight as soon as I get the confirmation.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/03/07 10:09:46
Subject: RE: Meeting Newfoundland Power - ABB

Good morning Alain,

We have reviewed the dates and propose the original date of the 20th and if not the 27th will be okay.

Cliff

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/03/13 11:39:51
Subject: RE: Confirmation for Meeting Newfoundland Power - ABB

Good Morning Alain,

We would like to prepare for our meeting on the 27th to discuss your findings on the hanger brackets and thus request that you send us a copy of your findings/report for perusal prior to the meeting.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/03/13 12:00:53
Subject: RE: Confirmation for Meeting Newfoundland Power - ABB

Good morning Cliff,

Our engineer consultant is in vacation this week. We have his report as a draft and the report will be finalized pretty soon. We anticipate sending a report next week.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/03/19 17:09:00
Subject: RE: Confirmation for Meeting Newfoundland Power - ABB

Good afternoon Cliff,

Please look at the file attached.
We will discuss and clarify those issues.
Could you confirm the time of the meeting ?

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/03/20 13:02:35
Subject: Fw: Confirmation for Meeting Newfoundland Power - ABB

Cliff,

I suggest to begin the meeting around 8 o'clock in the morning to be sure we will cover all topics.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/03/20 12:45:20
Subject: RE: Confirmation for Meeting Newfoundland Power - ABB

Good morning Cliff,

We will arrive in Newfoundland in the afternoon of March 26th and our returning flight is scheduled at 17:10 PM on March 27th.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/03/20 11:57:42
Subject: RE: Confirmation for Meeting Newfoundland Power - ABB

Good morning Alain,

We have booked a meeting room for the morning of March 27th. The time is dependent on your flight arrival to St. John's. Please advise me of the time you will arrive in St. John's and I will confirm the meeting time and location.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/03/20 14:46:05
Subject: RE: Confirmation for Meeting Newfoundland Power - ABB

Thanks Cliff, We will see you next thursday.

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/03/20 14:21:12
Subject: RE: Confirmation for Meeting Newfoundland Power - ABB

Alain,

The meeting will be at 8:30 AM in the Don Bragg Room on the first floor of our Duffy Place Building located at 50 Duffy Place in St. John's. Upon arrival at the building you should contact Trina Troke, Superintendent Regional Engineering at (709) 737-5237 or cell (709) 685-1416.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/03/31 09:31:44
Subject: Meeting - ABB - Newfoundland Power

Good morning Cliff,

Please review the minutes of meeting below and let me know your comments.

The meeting took place in Newfoundland Power facilities on March 27th. Were present at the meeting:
NP: Mike Jardine, Cliff Rose, Kevin Green, Trina Troke, Wanda Brown, S. Wall
ABB: Alain Tremblay, Robert Gingras, Jean Massé (Service d'ingénierie Jean Massé)

* Failure of RP-91 have been discussed. A transformer from another supplier fell from a pole and have been replaced by an ABB transformer. The lower bracket of that transformer failed. The pole was moving and NP installed guide wires on that pole.

* ABB have presented a preliminary report. Based on test done and calculation, from a third party expert the 0.14 thickness bracket is meeting CSA 2.2 specification. Using CSA test criteria plus an extra 150%, the results where still OK. ABB cannot explain the failures based on the

bracket design and the specifications. It was also mention that the 0.14 bracket design was an existing design suplied to another customer starting in 1990, in the same type of application and no failure had been reported. Possible failure mode and their impacts have been presented and discussed (torque, pole size, extreme wind condition). Combination of those factors can have an impact. ABB cannot provide more information without getting installation procedure and field condition.

* NP will make a survey on 200 to 300 units installed in the field. They will investigate and collect the following data in order to find some clues or evidence.

Poles size and diameter
Bracket distortion (pictures will be taken if any distortion)
Pole stability or solidity
Torquing (bolt loose)
Cracking
Locations of the units (Geography).

NP will communicate to ABB the information on the site condition of ther failed units.

* NP has 4430 50KVA units installed and 150 in hold in their backyard. ABB will see if it can propose a solution for the 150 units in inventory, by next week.

* NP showed a 25 KVA found hanging by bottom bracket due to a failure of the top one.

* ABB will issue for revision a step report in 2 weeks.

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/03/31 13:24:55
Subject: RP-236

Good morning Cliff,

As discussed at our meeting on 27th please ship back for repair the following hanger brackets failed units using RP-236

Style Number: TA0025DDA0M-002
Serial: 61619-0018
Manufactured date: 03-2003

Style Number: TA0050MMA0M-001
Serial: 61648-0001
Manufactured date: 03-2003

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/04/03 09:06:25
Subject: FW: Failure of the transformer bracket

Good morning Alain,

We have just been advised of another 25 kVA transformer hanger bracket failure. This unit was installed on the West Coast of the Province in our Stephenville Area. I have requested more information on the installation and will advise you when further details are available.

Regards,
Cliff

>From: Brown, Wanda C.

>Sent: April 3, 2008 8:34 AM
>To: Payne, Ralph; Duffy, Roddy; Hynes, Remi
>Cc: Rose, Clifton; Troke, Trina; Green, Kevin
>Subject: FW: Failure of the transformer bracket >Importance: High

>Hi Ralph,
>
>I'm sending your email to Cliff and Trina for review. In the meantime please ensure this unit stays in the warehouse so that it is available for transfer or inspection once a plan of action is decided.

>Thanks,
>Wanda

>From: Payne, Ralph
>Sent: Wednesday, April 02, 2008 4:19 PM
>To: Brown, Wanda C. >Cc: Duffy, Roddy; Hynes, Remi

>Subject: Failure of the transformer bracket

>This was from Pont Au Mal, an area where we get a lot of wind, this is a stainless 2003 model, the bottom bracket was completely split and the top bracket steel was twisted, only thing is it's a 25 KVA>

>Ralph
>

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/04/03 13:45:10
Subject: RE: Meeting - ABB - Newfoundland Power

Hi Alain,

Attached are a few notes on the failures that we discussed. There are a couple of corrections/additions to the previous discussion report.

Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/04/03 14:06:10
Subject: RE: Meeting - ABB - Newfoundland Power

Thank you Cliff,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/04/24 17:03:02
Subject: Fw: Step report

Good afternoon Cliff

As discussed over the phone this afternoon we will provide a solution for your transformers in hold in 3 weeks. We are looking to produce reinforcement plates having a triangular shape to be inserted inside the mounting brackets.

We have a delay since our supplier has to modify his tooling to produce the reinforcement plates. More informations will follow when final design and tests will be completed.

We discussed also about survey to be done by Newfoundland Power. The results will be available by the end of June.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/04/24 13:41:01
Subject: Step report

Good afternoon Cliff,

As discussed at our meeting in March, you will find attached our step report, regarding the mounting brackets issue. Please take a look at this report and let us know your comments.

Luc and I will contact you this afternoon regarding the next steps.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/05/26 13:22:04
Subject: Solution for 150 transformers 50 Kva on hold

Good morning Cliff,

In order to solve your issue on having place a hold on stock of older version transformers we are suggesting the following solutions.

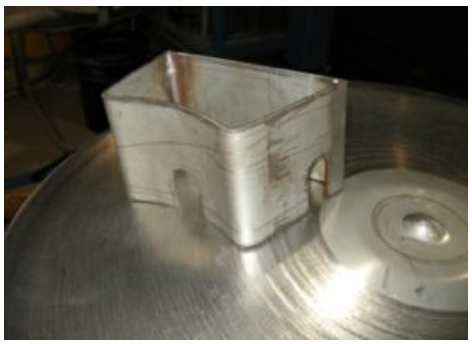
* We have designed reinforcement plates made of Stainless Steel 316L to be added inside top and lower brackets on each transformer.

Those reinforcement plates are easy to install and do not requires any particular tools. For top brackets, the operator has to press out a nameplate rivet with a hammer then insert the reinforcement plate by hand and get the rivet back on its original location. The lower reinforcement plate do not require any tool since you have to put them in place by hand. (see pictures attached)

* The other solution is the substitution of existing hanger brackets by thicker brackets. In that case the transformers shall be returned back at our facilities for disassembly. Our tank manufacturer would change the hanger brackets and ship back the tanks here for reassembly and testing.

Please let us know your comments.
Best regards

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com



From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/05/29 16:32:03
Subject: FW: Transformer Bracket Failure

Attached are a few pictures of a unit found during our inspections with a broken lower bracket.

We are in the process of our inspections and hope to have some of the results to share with you shortly.

Regards,

Cliff

>From: Troke, Trina
>Sent: May 23, 2008 2:17 PM
>To: Rose, Clifton
>Subject: FW:
>
>FYI

>The unit will be shipped here to Duffy Pl.
>
>Trina

>From: Keating, Barry
>Sent: Friday, May 23, 2008 10:31 AM
>To: Troke, Trina
>Cc: Scott, Walter
>Subject: FW:>
>
> Trina,
> Transformer with name plate in tact will be shipped on Tuesday
> Barry




From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/05/30 16:07:21
Subject: RE: Solution for 150 transformers 50 Kva on hold

Hi Alain,

Would it be possible for us to receive about 15 reinforcement plates for review before we make our decision on the alternatives?
Thanks,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/05/30 16:23:45
Subject: RE: Solution for 150 transformers 50 Kva on hold

Cliff,

We have 5 pairs of reinforcement plates here. I could ship them on next monday. Would it be enough for your review ?

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/06/02 09:36:21
Subject: RE: Solution for 150 transformers 50 Kva on hold
Attachments: Top Bracket Reinforcement Plate Installation.wmv
Lower Bracket Reinforcement Plate Installation.wmv
Bolt Installation.wmv

Cliff,

Please give me the address where I have to ship the plates.
I have also attached 3 videos for your staff showing the plates installation.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/06/02 08:38:53
Subject: RE: Solution for 150 transformers 50 Kva on hold

That would be fine.

Thanks,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/06/02 15:18:03
Subject: RE: Solution for 150 transformers 50 Kva on hold

Cliff,

Plates are leaving Quebec today.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/06/02 10:10:55
Subject: RE: Solution for 150 transformers 50 Kva on hold

Alain,

You should send the plates to our central warehouse at:

Newfoundland Power Inc.
3 Mews Place
St. John's, NL
A1B 4M5

They can be sent to Trina Troke's attention.

Thanks,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/06/20 13:24:01
Subject: Fw: Solution for 150 transformers 50 Kva on hold

Good afternoon Cliff,

Did you installed the plates ?
How is going your evaluation ?

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/09/17 15:39:29
Subject: FW: Transformer Inspection update

Hello Alain,

Attached is the transformer survey results of the inspection of 576 transformers. Please review the information and forward us your comments.

Regards,

Cliff

Area	Size	Year	Pole Dimension	Pole Class	Pole Ht	Comment
SJN	25	2005	31.5	3	40	bracket flattened out against pole
SJN	50	2005		4	45	brackets bowed outwards; distorted
SJN	50	2005	29	4	40	brackets discoloured
CBK	25	2003	30	4	40	Distorted Upper bracket
SJN	50	2003	28	4	40	hairline crack in brackets
CAR	50	2004	30	4	40	lower Bracket cracked, distortion for either not reported, not down on top bolt
GAN	10	2004	32	4	40	Stressed metal
CAR	25	2005	32	4	40	Upper and Lower brackets distorted
SJN	50	2006	29.25	4	45	Upper and Lower brackets distorted
CAR	25	2002	26	4	40	Upper bracket distorted, Welding is bubbled
CAR	25	2005	35	4	50	Welds are rusty
BUR	50	2006	28	4	40	Xfmr needs to be replaced ASAP, Lower Bracket Distorted and cracked
SJN	25	2005	31.5	3	40	bracket flattened out against pole
SJN	50	2005		4	45	brackets bowed outwards; distorted
SJN	50	2005	29	4	40	brackets discoloured

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/09/17 14:46:00
Subject: RE: Update on Survey and Reinforcement Plates

Hi Alain,

Sorry for the delay on these items.

I received the survey data late last week and wanted to review the information prior to sending it to you.
We tried the reinforcement plates prior to the summer period and did not get favourable comments. In the first transformer we tested the plates would not fit without forcing. Due to this difficulty in installing the plates, it is questionable if the plates will actually be installed in the field. It is our preference not to use the plates, but to return the transformers for bracket replacement.

Cliff

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/09/18 13:57:11
Subject: RE: Talks summary over the phone yesterday.

Good Day Alain,

Your summary is as we discussed yesterday. Newfoundland Power (NP) would like a solution that will not require field personnel to do anything differently than their present practice. A change may not be consistently applied and thus may be subject to error. NP is requesting ABB investigate the possibility of developing a reinforcing plate to add to the outside of the existing brackets. NP is requesting ABB determine the best method to secure the plate to the bracket prior to the transformer going to the field for installation. If welding, either spot or a continuous weld is the best alternative, NP would arrange to have a local welding shop complete the installation. A non-weld solution that ensures the plate will not easily be removed will also be considered.

If this option is viable, then the 150 units presently on hold as well as all other units with the 10 gauge brackets could be retrofitted using the outside plates. Units presently awaiting refurbishment and units currently installed in the field would be retrofitted on a go-forward basis or otherwise as determined by NP.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/09/18 11:02:01
Subject: Talks summary over the phone yesterday.

Good morning Cliff,

Please take a look at this and confirm.

Newfoundland tried the reinforcement plates on some transformers in their backyard. The comments from the staff are as the following:

* The plates are difficult to install because they don't fit perfectly on some transformers.
* The plates could fall during transportation from Newfoundland Facilities to the field.
* The plates cannot be used on transformers having distorted brackets.

I explained that this solution is the cheapest for the 150 transformers in hold. Newfoundland Power is suggesting to ABB to supply reinforcement plates designed to fit on the outside of the brackets.

Newfoundldnd Power is willing to weld the plates on the transformer brackets in their refurbishing shop. Those plates could be used for the 150 transformers in hold in their backyard and for the repair of distorted bracket as well. Newfoundland Power will have to remove the nameplate on top bracket, then weld the reinforcement plate on the existing bracket and reinstall the nameplate. The bottom reinforcement plate would be designed the same way.

Following that discussion ABB will look at the design of reinforcement plates to be fitted on the outside of the brackets. Those plates design will be summitted to Newfoundland Power for approval prior to the production of samples.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/09/23 17:02:51
Subject: Reinforcement Plate - New Design
Attachments: TOP BRACKET REINFORCEMENT.pdf
BOTTOM BRACKET REINFORCEMENT.pdf

Bonjour Cliff,

As per our latest discussion we made an analysis and come to the following conclusion.

The welding option is a risky process. We need to heat to the melting point to get a suitable weld. That's involve an extreme heat on the tank and that process could be very hazardous on a complete enclosure filled out with oil. That process could damaged the transformers and is hazardous for workers.

We suggest a bolted outside reinforcement plate which would be easy to install and would secure the transformers on the pole. I have designed two reinforcement plate. One to be used on the top bracket and another plate to be used on the bottom bracket.

The plates would be delivered with necessary drilled holes. Your staff would have to drill holes in transformer mounting bracket and installed bolts as shown. Those plates could also be used on units presently installed in the field.

Please look at the drawing attached and let me know your comments.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton
To: alain.r.tremblay@ca.abb.com
Date: 2008/09/26 14:03:37
Subject: RE: Reinforcement Plate - New Design

Hello Alain,

We have a few questions on the bolt on design.

1. Is it necessary to have 2 bolts per side or could 1 bolt per side be used to hold the plate in place?

2. Will the plate add or shift stress to the existing bracket at the weld location?

3. Will we be able to get a few samples for trial installation?

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/09/30 12:20:29
Subject: RE: Reinforcement Plate - New Design

Good morning Cliff,

Here are the answers to your questions.

1. The purpose of two (2) bolts per side enhance the backing of the reinforcement plates by maintaining a more uniform pressure between both plates on four (4) fastening points. The stress loading is divided on the 4 bolts and contribute to lower the stress loading on the pole mounting bolting area. The 4 bolts design also contributes to the strengthening and stiffness of that assembly. We strongly recommand to use 4 bolts design.

2. Based on computer calculation that reinforcent plate design will not shift or add any stress at the weld location. In fact we are getting the opposite result. The plates when installed will stabilize the horizontal and vertical movement of the transformer and lowered the stress at the weld location.

3. Samples will be available for trial installation within two (2) weeks at your request. Let me know how many plates you need.

Waiting for your comments.
Best regards

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021

email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/10/03 08:33:27
Subject: RE: Reinforcement Plate - New Design

Good Morning Alain,

Could we have 4 samples of both top and bottom plates? Is there a special drill bit required for drilling the stainless steel?

Regards,
Cliff

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/10/15 09:17:53
Subject: RE: Reinforcement Plate - New Design

Good Morning Alain,

Just looking for an update on the reinforcement plates. I realize that you initially said shipping would be 2 weeks from the request date which will be this Friday the 17th. Have the sample plates been shipped? If not, what is the anticipated shipping date?

Regards,
Cliff

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/10/16 13:20:12
Subject: RE: Reinforcement Plate - New Design

Hi Alain,

Please ship the samples to me at:

Newfoundland Power Inc.
30 Goff Avenue
Carbonear, NL
A1Y 1A6

Thanks,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/10/16 12:59:39
Subject: RE: Reinforcement Plate - New Design

Good morning Cliff,

I expect to have the samples by the end of next week (friday October 24th) and I will ship them quickly as soon as tests and verification will be done here.

Please send the address to ship the samples.

Regarding the bit for drilling holes, you need to have bits made of Titanium for drilling.

Our tank manufacturer use a lubricant paste when drilling to avoid bit overheating. This paste is called Rocol. You can have more information by visiting the web site below which is the distributor for this product in Quebec City. The product is number is HU100-03

http://www.equipementpolar.com/index_en.html

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email: alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/10/29 15:50:19
Subject: RE: Reinforcement Plate - New Design

Hi Cliff,

I've received the samples today. I checked them out and found everything was fine.
Samples will be ship today or tomorrow to your attention. Sorry for the delay,

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/11/07 17:36:28
Subject: RE: Reinforcement Plate - New Design

Hi Alain,

I have received the samples, 4 bottom and 6 top brackets. I tried a dry fit yesterday and there are a few concerns:

1. The brackets are not the correct size. I believe they should be a little bigger than the existing bracket on the transformer in order to fit outside the existing bracket. The bracket received is exactly the same size as the bracket it is supposed to fit over.

2. The bottom bracket has the hole for the ground connector on the wrong side. As well, if we turn the bracket upside down, the hole for the ground connector appears to be in the wrong place as there is no room for the washer.

3. The holes for the nameplate appear to be in the wrong location and do not line up.
4. The inner holes on the new brackets will be close to the tank and appears that it will prevent the nuts and bolts from being installed.

Have you tried to install the brackets on a test transformer?

Cliff

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/11/10 15:12:09
Subject: RE: Reinforcement Plate - New Design
Attachments: Pics.msg

Hi Alain,

Attached are a few pictures of the reinforcement plates on an existing transformer in our shop. As per the pictures, the reinforcing plate if laid upon the existing bracket is identical in size and would have to be distorted to fit down over the existing bracket. The transformer is a 50 kVA manufactured in 2004.

Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/11/10 11:14:50
Subject: RE: Reinforcement Plate - New Design

Cliff,

The bracket have been manufactured the correct size. Our tank manufacturer has

modified the tooling and verified the brackets on the outside of an existing bracket.
The plates shall be inserted from the top and coming down on the existing bracket.
I've tried the plates on a transformer here and they fitted the shape of the brackets.
Luc was present with me and everything was OK

Please could you send picture of what is wrong.

Meanwhile I will order a pair of bracket and make another test here. I will make a video showing how the plates shall be installed and I'll be sending that video to you.

Regards

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/11/11 16:43:09
Subject: RE: Reinforcement Plate - New Design
Attachments: Mounting Bolt.pdf

Cliff,
Please find below the answers to your concerns,

1. The brackets are not the correct size. I believe they should be a little bigger than the existing bracket on the transformer in order to fit outside the existing bracket. The bracket received is exactly the same size as the bracket it is supposed to fit over. I saw on the picture you try to install them the wrong way. You have to slide the new bracket on the old bracket from top downward and they fit over. This is the only way to fit the brackets.

2. The bottom bracket has the hole for the ground connector on the wrong side. As well, if we turn the bracket upside down, the hole for the ground connector appears to be in the wrong place as there is no room for the washer. You are right. The brackets have been manufactured with the connector hole on the wrong side. That will be corrected with our supplier. Once the plate is properly installed there is enough room for the washer.

3. The holes for the nameplate appear to be in the wrong location and do not line up. The mounting holes do not have to be in line with the old nameplate holes. You have to drill holes in the existing bracket using new mounting holes as a guide.

4. The inner holes on the new brackets will be close to the tank and appears that it will prevent the nuts and bolts from being installed. The inner holes will be close to the tank but there are space enough to install nuts. We may have a concern when installing a bolt from the inside of the bracket but there is a way to avoid this problem. (See file attached)

I have ordered 4 bottom plates and I will have them tomorrow. I will make the whole installation process on an existing tank here making video and pictures and I'll come back to you with a

complete installation process.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/11/12 18:29:59
Subject: RE: Reinforcement Plate - New Design
Attachments: Installing the pletes.avi

Cliff,

The plates look as they have the same dimension but it is different. You have to remove the nameplate before. Did you remove the nameplate ?

Today I received 4 pairs of bracket, installed one on a top bracket with bolts and everything was working. I have videos of the installation but I'm not able to convert them because its big, big files.

Anyway look at the first video showing how to insert the plates and drill holes. Tomorrow I will try again and if I'm not able to convert them I will send pictures instead.

Alain Tremblay
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Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/11/12 17:38:28
Subject: RE: Reinforcement Plate - New Design

Alain,

The pictures may not be clear. We tried to install the bracket from the top, bottom and outside but it would not fit in either way. The bracket is exactly the same size as the bracket on the transformer. So unless the bracket is distorted by forcing it apart, it will not fit over the existing bracket. However, we will await your videos and instructions.

Thanks,

Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/11/13 11:47:03
Subject: RE: Reinforcement Plate - New Design

Cliff,

As discussed this morning could you send the serial number of the unit on the picture. I will make a test to know if I'm able to find in our system who have been manufacturing the tank.
Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/11/13 13:04:02
Subject: RE: Reinforcement Plate - New Design

Alain,

The serial number is 1121877-008. It was manufactured 09-2004. It is a 50 kVA, 14,400-120/240 volt unit.

Cliff

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/11/14 17:14:07
Subject: RE: Reinforcement Plate - New Design

Hi Alain,

As we discussed yesterday, I tried the reinforcement brackets on a number of transformers on our ramp this morning. I also checked our files and it appears that the tank manufacturer was changed from Framco to Group GL in 2005. The units I checked today were manufactured in 2001, 2002 and 2004. I also checked different size transformers. In most cases the brackets did not fit, however the brackets did fit one transformer. It was a 10 kVA manufactured in 2001.

I had expected a difference in tanks from Framco and Group GL, but these tanks would have all come from Framco. Does this mean that the brackets may be different in different years or batches of brackets/tanks from Framco? Could there be more than two different sizes or minor

variations that would make installation of the reinforcing brackets difficult?

Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/11/14 18:07:15
Subject: RE: Reinforcement Plate - New Design

Hi Cliff,

We began to receive tanks from Groupe JL in January 2003. Considering that we have produced transformers in a short period of time with tanks coming from both suppliers, we have tanks from Frameco and Groupe JL in the first quarter of 2003 and we have switched to Groupe JL in the second quarter of 2003.

To my knowledge there was no more than two different sizes. We made minor changes only, over the years as nameplate holes on the other side; things like that. No change have been made on dimensioning and Frameco always used the same tooling and setup to produce those components. However it may be possible to have minor variations because they can't produce very same components. They had to work inside manufacturing tolerances.

Also I have tried plates on transformers here with Luc and we noticed that it is difficult to fit the plate with the nameplate and the ground connector on the bracket on the bottom. The bracket looked that it didn't fit but that was not the case when trying with those components removed.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
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Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/11/25 18:02:09
Subject: RE: Reinforcement plates from Groupe JL
Attachments: Frameco.pdf Groupe JL.pdf

Cliff,

See in red below the tank manufacturer. As per my investigation I'm sure the fourth transformer manufactured in 12-2002 has a Groupe JL tank. In fact we have changed our Software Manufacturing System at the beginning of 2003 and I'm not able to track the tank manufacturer in our old system to confirm. But I'm pretty sure now that we have 2 styles of brackets: one Groupe JL bracket and one Frameco bracket. The only difference between them is the width of the bracket.

The bracket manufactured by Groupe JL has the following dimension: 130mm Width
The bracket manufactured by Frameco has the following dimension: 118mm Width

Please look at the files attached.
The Groupe JL brackets are a little larger. That's why the reinforcement plate made by Frameco does not fit and are exactly the same size. This way it would be easy to determine what reinforcement plates you need: Frameco or Groupe JL

Could you provide me with the width of the brackets (as per the files attached) of the four transformers ?

Regards

Alain Tremblay
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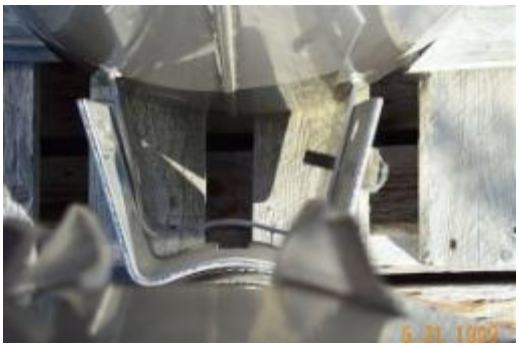
email:alain.r.tremblay@ca.abb.com



From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/11/25 12:51:41
Subject: Reinforcement plates from Groupe JL

Good morning Cliff,

As discussed over the phone this morning, we agreed the following

* I will have samples (one for top bracket and one for bottom bracket) from Groupe JL today or tomorrow and I will ship them to your attention right away. You will try them on transformers and will let me know your comments.

* I have ordered 6 revised bottom plates from Frameco. So your will have 6 pairs of plates ready to installed on Frameco's tanks.

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/11/26 12:15:13
Subject: RE: Reinforcement plates from Groupe JL

Cliff,

As I explained over the phone at the beginning of the week Groupe JL has been changing their tooling to produce thicker bracket in 2006. They will be able to produce the reinforcement plates to be fitted over the old brackets but they need to have an old bracket to make the setup to produce a plate that will fit perfectly. Unfortunately we don't have here any old tank made with the thin bracket and Groupe JL don't have too.

Therefore we will have to ship back a transformer to Groupe JL so that they will be able to verify the bracket and make the setup to produce plates.

I suggest the following:

Newfoundland Power will ship back 2 transformers here at our plant. One of them will be ship to Groupe JL. They will do what they have to do to produce the brackets. We will order another pair of reinforcement plate to repair the other one here at our plant. Both transformers will be repaired and send back to newfoundland Power. This way we will be able to modify anything wrong in order to minimize the problems for Newfoundland Power

If you agree with that suggestion I will ask to Yves Fortier to arrange with Newfoundland Power to send a truck for transportation.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021

email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/11/26 09:57:20
Subject: RE: Reinforcement plates from Groupe JL

Alain,

The fourth bracket is the same as the other two 50 kVA units. I had suspected that it may have been a Groupe JL bracket. It appears that we will require both Frameco and Groupe JL reinforcing brackets. I would estimate that the units presently being held in our Stores are all Groupe JL tanks.

Cliff

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/11/27 14:03:11
Subject: RE: Reinforcement plates from Groupe JL
Attachments: RE: Reinforcement plates from Groupe JL.msg

Alain,

As requested, we have two transformers in our Stores at St. John’s ready to ship to you. The serial numbers are listed in the attached email. There are AB1101241-001 and -008. You should coordinate the shipping with Tony Caul at our St. John’s warehouse.

Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/12/02 14:11:20
Subject: Bottom Bracket Reinforcement Plates

Good afternoon Cliff,

I received 6 bottom bracket plates from Frameco. Those plates shall be used with Frameco's tanks. I tried them and they fit perfectly. I'll be shipping them to your attention tomorrow.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/12/12 16:13:57
Subject: RE: Bottom Bracket Reinforcement Plates

Hi Cliff,

I have asked to our supplier and there is no particular reason about the thickness. He ordered 3/16" thickness. The manufacturing tolerances is +/- 0.009" So the thickness should be in the following range: 0.1785" to 0.1965"

This will be checked when we will order new plates.

On my side I expect to receive 2 samples from J.L. Leclerc by the beginning of next week. We will try to weld them on the transformers that we have received on last Monday. My main concern with the welding is the lid gasket.

I keep you posted.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2008/12/12 12:45:32
Subject: RE: Bottom Bracket Reinforcement Plates

Hi Alain,

I have received the 6 bottom brackets and I noticed that they are made from a different thickness steel. It looks like the previous brackets were made from gauge 5 steel and the latest brackets are made from gauge 7 steel. Any particular reason why these would be different?

I will arrange with our people to identify a Frameco tank and try the brackets.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2008/12/17 17:46:28
Subject: RE: Bottom Bracket Reinforcement Plates

Good afternoon Cliff,

I received the samples from J.L. Leclerc today. The good news is that finally we have plates that fit exactly the shape of the brackets. (Groupe J.L.)

Unfortunately we will not be able to perform the welding test before Christmas Holidays. I hope to make that test mid-January.

Attached are pictures of the top bracket plate.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/06 17:00:32
Subject: Transformer Hanger Bracket Thickness

Hi Alain,

Happy New Year!

Would you please provide the thickness and gauge of hanger brackets for each size pole mount transformer presently supplied to us? We are in the process of including a minimum thickness in our transformer specification.

Regards,

Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/07 10:37:21
Subject: Re: Transformer Hanger Bracket Thickness

Hi Cliff,

Happy new year to you and all menbers of your team at Newfoundland Power.

Below is the thickness of hanger brackets.

10 kva up to 50 kva : 3/16" (0.1875")
75 kva up to 167 kva : 1/4" (0.25")

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/13 10:12:25
Subject: RE: Reinforcement Plate update

Hi Alain,

Thanks for the update.

We do have equipment to lift the transformer by the lifting lugs. We also lift the transformer on a pallet using a forklift.

Regards,
Cliff

From: "Rose, Clifton
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/16 10:20:35
Subject: Broken transformer.. 50 kva.

Good Morning Alain,

For your information, we have had another 50 kVA transformer removed from the field with a

broken lower bracket. The message below refers to a “thick mounting bracket” on the transformer, however, we have confirmed that it is gauge 10 (0.140”). The reference to a thicker bracket raised concern.

The failure again emphasizes the need to address the transformer brackets in the field as well as those presently in our stores.

Regards,
Cliff

From: Moore, Geoff
Sent: January 15, 2009 3:44 PM
To: Keating, Barry
Cc: Rose, Clifton; Brown, Wanda C.; Stephenson, Eric Subject: FW: Broken transformer.. 50 kva.

This trans was taken down today in Bonavista. Call came in this morning after high winds last night. Trans moving in pole.
50 KVA
Trans # 2497139
M Date 01 2003
Serial # 60448 – 0006

Also this transformer had the thick mounting bracket.

From: Keough, Robert
Sent: Thursday, January 15, 2009 3:14 PM
To: Moore, Geoff; Keating, Barry
Subject: Broken transformer.. 50 kva.

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/19 17:48:46
Subject: Re: FW: Broken transformer.. 50 kva.

Cliff,

I have a few questions regarding that unit:

Did you investigate the installation parameters such as pole diameter, distance between holes torque on bolts, bolts alignment etc. ? Did you note something abnormat ?

We have had some failures on the lower bracket and it is unusual. Did the load on the top or on the lower bracket ?

Regards,

Alain Tremblay
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From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/19 12:25:21
Subject: Re: FW: Broken transformer.. 50 kva.

Good morning Cliff,

Could you send a picture of the nameplate regarding that unit. I will send you tommorrow a RP number in order to ship back that unit for refurbishment.

Regarding the reinforcement plates on the units in the shop the weldings will be performed tomorrow.

I'll keep you posted.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/20 12:26:16
Subject: RE: FW: Broken transformer.. 50 kva.

Hi Alain,

I will forward the questions along to our field staff. There were no reported anomalies in the initial report.

Cliff
From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/20 17:14:52
Subject: RE: Reinforcement Plate update

Cliff,

When you talk of a larger quantities, are you talking about the 150 transformers in hold. If so we will supply all installation hardware (bolts, nuts washers) along with the plates.

I need to have the quantities from J.L. and Frameco to get the lead time.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/20 16:36:01
Subject: RE: Reinforcement Plate update

Alain,

Please forward the samples to us.

What timeframe do we have for larger quantities of the brackets, both Frameco and J. L. Leclerc?

Will the bolts be supplied with the brackets?

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/20 16:27:13
Subject: RE: Reinforcement Plate update
Attachments: TOP BRACKET REINFORCEMENT.pdf
BOTTOM BRACKET REINFORCEMENT.pdf

Clif,

You will find the drawings attached. You will have the same holes dimensioning setup for both plates. If you wish to have samples I have 2 pairs of plates here that I could modify by adding mounting holes. Those plates can be used on J.L. Leclerc tanks.

Waiting for your approval.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/20 14:14:39
Subject: RE: Reinforcement Plate update

Alain, you can send a drawing as a final check.

Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/20 14:05:42
Subject: RE: Reinforcement Plate update

Hi Cliff,

I agree with you.

This process is preferable to the welding of the bracket and we can supply the plates with the holes aligned vertically My first idea was to use a hydraulic punch, but I thought you did not have this equipment. If you can punch the holes, that become a lot easier.

We did not weld the plates yet. I will put that on hold and will work on the plates design changes.

Do you want me to send a drawing ?

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/20 13:12:04
Subject: RE: Reinforcement Plate update

Hi Alain,

We have installed the lower reinforcing bracket on a Frameco tank using a hydraulic punch to punch the holes in the existing bracket. This installation took only a few minutes. The longest time is setting up the punch. The actual punching of the stainless steel took only a few seconds and is much faster than using a drill.

The only issue is that the bolt holes have to be vertically aligned and not horizontally. We received reinforcing Frameco brackets with the bolt holes horizontal in one case and vertical in another. If the brackets can be supplied with the holes vertically aligned for both top and bottom brackets, then we can attach them to existing transformers by using the punch to make holes in the existing brackets.

This process is relatively quick and may be preferable to welding the brackets.

What are your thoughts on this process?

Regards,

Cliff

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/21 09:40:36
Subject: RE: Reinforcement Plate update

Alain,

I would suspect that 80 to 90% of the 150 are J. L. Leclerc, therefore let's say we have 120 J. L. Leclerc and 30 Frameco units.

We do have to deal with the transformers presently installed in the field, however, we have not developed a plan to address these units.

Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/23 14:15:57
Subject: RE: Reinforcement Plate update

Cliff,

We do have a 4 weeks lead time for J.L. Leclerc tanks.
I'm still waiting for Frameco leadtime.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/23 14:17:38
Subject: RE: Reinforcement Plate update

Thank-you Alain!

Cliff

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/26 14:29:48
Subject: RE: Reinforcement plate welding test

Hi Alain,

Please proceed with the welding option and advise me of your comments.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/26 14:09:22
Subject: Reinforcement plate welding test

Good morning Cliff,

I put in hold the welding of the reinforcement plates last week on the transformers that you shipped back for repairing of the mounting bracket.

But I thought about that and I'd like to test the welding of the plates to get a better evaluation of that repairing option. This way I could forward you my comments and observation and we could compare which one would be the best to us. What do you think about that ?

Waiting for your comments.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/30 13:04:05
Subject: Pictures

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/30 13:02:28
Subject: Pictures

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/30 13:20:10
Subject: Fw: Reinforcement Plate - Lead Time

Cliff,

We do have also 4 weeks lead time to get the plates for Frameco tanks.

The plates will be delivered here (J.L. and Frameco) at our facilities and we will add the hardware before shipping them to Newfoundland Power.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/01/30 11:48:45
Subject: RE: Reinforcement plate welding test

Hi Alain,

I’m not aware of a limit on the size of the pictures that can be received at this end. You could reduce the size of the file or send them in different emails.

In terms of the welding versus the bolts, will you be recommending one method over the other? I'd like to bring the issue to a conclusion and address the units that we have on hold. The bolts may be easier for us as opposed to having qualified welding of stainless steel.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/30 10:52:52
Subject: RE: Reinforcement plate welding test

Good morning Cliff,

We have proceeded successfully with the welding of plates yesterday. That's make a good and clean job. It takes about 15 minutes per units.
I'm trying to send pictures and I receive a delivery failure message because the size exceed the 552k limit. Do you have a size limit for e-mail ? Is there anything I can do ? To send a CD with the pictures ?

Regards,

Alain Tremblay Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/01/30 12:43:39
Subject: RE: Reinforcement plate welding test

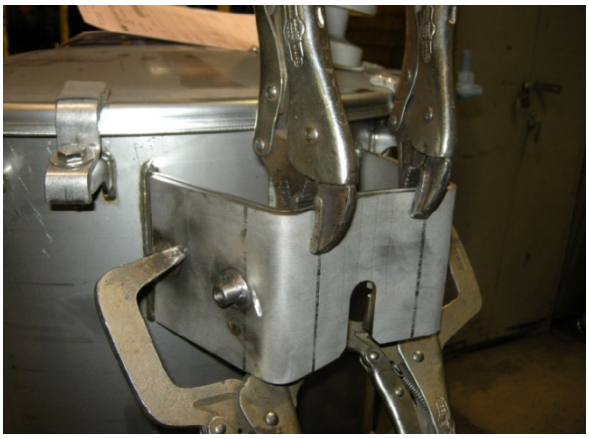
Hi Cliff,

Both method are acceptable to us and reach the goal which is to secure the transformer brackets. Both have advantages and disavantages to get the job done.

One over the other can be easier for newfoundland Power. It's up to you. I will send more informations regarding the welding option so that you can evaluate both options and choose one of them to bring the issue to a conclusion. I attached few pictures and I'll be sending other pictures in different emails.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com





From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/02/20 15:28:04
Subject: RE: Reinforcement Plates

Hi Alain,

Please ship the brackets to Tony Caul at our Duffy Place Warehouse. We have decided to bolt the brackets rather than have them welded. We believe this will be an easier process for our people and require less equipment as well as expertise.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/02/23 10:39:23
Subject: RE: Reinforcement Plates

Hi Cliff,

We will ship the plates along with the necessary hardware. Do you want us to order the other plates for J.L. Leclerc tanks. If so how many pairs of plates do you need ?

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/02/24 13:36:54
Subject: RE: Reinforcement Plates

Hi Cliff,

I was under the understanding on my side that you were evaluating both options and had to make a decision. I was waiting for your instructions. Sorry for the misunderstanding.

I have contacted our supplier to get a better lead time and we will have the plates here on March 11th (2 weeks lead time) On receipt we will add the hardware and we will ship the parts right away. So I expect you will receive the plates at your facilities by March 17th. I will keep you informed and I will have a tight follow up on this.

Meanwhile the 24 Frameco's plates are leaving Quebec today.

Sorry once again,

Best regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/02/24 12:46:40
Subject: RE: Reinforcement Plates

Hi Alain,

As per my email on January 21st, I was under the understanding that we had requested J. L. Leclerc plates for 120 transformers since these were the largest quantity of units that we had on hold. I was anticipating receiving these plates very shortly with a four week lead time.

Do I understand correctly that no plates have been ordered at this time from J. L. Leclerc for the units on hold and we will now be looking at another four weeks or more before we will receive the plates?

Cliff

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/03/10 14:33:35
Subject: RE: Reinforcement Plates

Hi Alain,

Please ship them to Tony at Duffy PLace.

Regards,

Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/03/10 13:21:35
Subject: RE: Reinforcement Plates

Good morning Cliff,

We have received the reinforcement plates (Qty: 119 pairs) from J.L. Leclerc. We are going to prepare and add the necessary mounting hardware and should be ready to ship on Monday March 16th

Do I ship them to the attention of Tony Caul at your Duffy Place Warehouse ?

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021

email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Caul, Tony"
Date: 2009/03/13 12:05:05
Subject: Fw: Reinforcement Plates

Good morning Tony,

The following material is leaving today our facilities to your attention.

* 119 pairs of reinforcement plates (119 top & 119 bottom)
* 1000 hot dip galvanized bolts 1/2" x 1 1/4" lg
* 1000 hot dip galvanized nuts 1/2"
* 1000 hot dip galvanized lock washers 1/2"
* 250 copper bolts 1/2" x 3/8"lg

That will be shipped at the following address

Newfoundland Power
3 Mews Place
St-John's, Newfoundland
A1B 3T6

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/04/29 09:20:42
Subject: RE: Engineering Change Notice

Hi Cliff,

Thanks for the feedback.
These are good news.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021

email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2009/08/13 08:56:47
Subject: RE: Reinforcement Plates

Good morning Alain,

I hope you have been having an enjoyable summer!

We have been busy installing reinforcing brackets on transformers and have used up all the brackets on the Frameco tanks. Would you please supply another 50 pairs of reinforcement plates for Frameco tanks and 25 pairs of reinforcement plates for J. L. Leclerc tanks?

They should be shipped to Tony as before.

Regards,
Cliff

From: "Alain R Tremblay"
To: "Rose, Clifton"
Date: 2009/08/17 10:49:54
Subject: RE: Reinforcement Plates

Good morning Cliff,

Yes I have been having an enjoyable summer an vacation.
I am just coming back from vacation today.
I will come back to you with a delivery lead time for those parts.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/08/31 15:34:11
Subject: RE: Reinforcement Plates

Good afternoon Cliff,

I expect to have the brackets here by the end of this week. We will prepare the necessary

hardware for installation and we should be ready to ship the parts during the week of September 14th.

I'll let you know when we will ready to ship.
Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2009/09/08 10:25:01
Subject: RE: Reinforcement Plates

Good morning Cliff,

The 75 pairs of reinforcement plates will be shipped today to Tony Caul
Please let me know your feedback about the assembling.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2011/04/20 11:12:57
Subject: Transformer Hanger Brackets

Hello Alain,

It’s been awhile since we last discussed the issue of transformer hanger brackets, so we thought it was time to provide an update on where we are with the issue and our thoughts on where we go in the future. But first, let’s review part of the history.

Transformers manufactured with 316L stainless steel were first purchased by Newfoundland Power (NP) from ABB in 2001 under a contract signed in November 2000. After the first stainless steel transformers were received, we received questions from our field staff on the thickness of the hanger brackets. Despite the assurances of the brackets ability to support the transformer, our staff continued to express concerns on the thickness and flexing of the brackets.

The first reported bracket failure was in 2003, where a lower bracket split after being installed for a few months. Since that initial failure, we have recorded failures to 22 transformers. Of the reported failures, 14 were 50 kVA units, 6 were 25 kVA units and 2 others did not have the size reported. The reported failures represent transformers manufactured each year from 2001 to 2006, inclusive.

The second reported bracket failure was in February 2006 and at that time we expressed our desire for a solution. In March 2006, you advised us that ABB would supply a thicker bracket for future transformers and all transformers received since 2007 have had a thicker bracket. While the thinner bracket has worked in other areas for other Utilities and meets CSA requirements for transformer hanger brackets, we agreed that a thicker bracket was required for the Newfoundland wind environment.

In October 2007, we had a 50 kVA transformer fall from a pole. This incident raised the level of concern for all parties and eventually led to transformers in our stores being held and not permitted to be installed in the field. This event also led to our meeting in March 2008, the inspection survey of 576 installed transformers, and the development of reinforcing brackets for the 150 units held in our stores.

During 2008 and 2009 we worked at getting an acceptable reinforcing bracket and discovered that we needed two different sizes as the brackets manufactured by Frameco and J. L. Leclerc were slightly different in size. Reinforcing brackets were supplied by ABB and installed by NP personnel on transformers on hold in our stores in 2009.

In December 2010 we had a second 50 kVA transformer fall from a pole, which again raised concerns with respect to transformers presently installed in the field with the thinner brackets.

From 2001 to 2006, we purchased approximately 5094 and 4435 transformers in size 25 kVA and 50 kVA respectively for a total of 9529 transformers. While a small quantity of these have had reinforcing brackets installed and others have likely been removed from the system, we would have in excess of 9000 transformers with the potential to have brackets fail and fall from the pole.

NP’s plan regarding these transformers in service has been to have them inspected as part of the routine distribution feeder inspections, which is on a 7-year cycle. In addition to this, we are proposing to sample a quantity of about 200 transformers for a closer more detailed inspection each year. The results of these inspections will be used to determine our future direction in addressing the issue with the brackets on these over 9000 transformers.

To date we have concentrated on the 50 kVA transformers in installing the reinforcing brackets. However, we anticipate that all these transformers will over time require reinforcing brackets. Another approach would be to install a type of device that would prevent the transformer from falling from a pole in the event of bracket failures. Are you aware of such a device that would act as a secondary support system?

Your comments are welcome!

Regards,
Cliff

From: "Alain R Tremblay"
To: "Rose, Clifton"
Date: 2011/04/21 16:53:21
Subject: Re: Transformer Hanger Brackets

Hello Cliff,

I'm not aware about any secondary support system
I'm going to make some searches and I'll let you know my findings pretty soon.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2011/05/02 10:56:31
Subject: Re: Transformer Hanger Brackets

Bonjour Cliff,

Unfortunately I did not find anything regarding a secondary support system. But we would like to support Newfoundland Power to find a solution with this issue. A secondary support system device will probably need to be developped, to achieve this goal. Therefore we need to know exactly what are your needs to make sure we will be working in a good way.

* Does Newfoundland Power have any design criterias ?
* Does Newfoundland Power have any ideas regarding how the design should be achieved ?
* I guess the transformers shoul not be removed from the poles ?
* Does the purpose of that device would be to prevent the transformers from falling from a pole only or a device that would secure the transformers by preventing a failure or a distortion of the brackets as well?
* In an ideal world how Newfoundland Power see that secondary support system ?

Any comments or ideas from Newfoundland Power would be welcome.

Best regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2011/05/11 10:47:47
Subject: RE: Transformer Hanger Brackets

Hi Alain,

My thought was to have a device that could be installed in the pole or on the existing transformer in the pole that would prevent the transformer from falling to the ground in the event that the hanger brackets fail. The goal would be to prevent the transformer from causing damage to surrounding property or people. I'm not sure what it would look like. Maybe an eye bolt and a rope around the transformer would be an alternative. But, we might wish to have something more than a rope. We are open to any suggestions.

For transformers that are removed from the pole due to normal replacements, we will continue to install the reinforcing bracket previously developed. This works well for transformers that are returned to the shop, but is not practical for a transformer in a pole. With thousands of transformers in poles, we need to have insurance that we will not have others fall from the pole. Part of our plan will include inspecting the transformers from time to time, but that in itself will not prevent one from falling. A program to bring each of the transformers back to the shop for installation of the reinforcing brackets would be costly and labour intensive. Therefore, we are looking for an option that will cost less to implement and will keep the transformer from falling out of the pole.

Cliff

From: "Alain R Tremblay
To: "Rose, Clifton"
Date: 2011/05/13 11:04:54
Subject: RE: Transformer Hanger Brackets

Hi Cliff,

Thanks for the explanation of your needs. Everything is clear to us. We will be working on this issue and come back as soon as possible with suggestions on a device that would secure transformers on the pole.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2011/05/18 13:32:44
Subject: Fw: Transformer Hanger Brackets

Hi Cliff,

I'm working on the secondary support design and I have a question. Does that device shall be installed with bolt passing through the pole as per the transformer bolts or the device could be installed using a kind of lag screws or screw bolts ?

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2011/05/20 15:44:12
Subject: RE: Transformer Hanger Brackets

Hi Alain,

We would be open to either option.

Cliff

From: "Alain R Tremblay"
To: "Rose, Clifton"
Date: 2011/06/02 16:29:14
Subject: RE: Transformer Hanger Brackets
Attachments: Secondary Support System OPTION #1.pdf
Secondary Support System OPTION #2.pdf
Secondary Support System OPTION #2 - 3 LAG SCREW.pdf

Bonjour Cliff,

We have been working on your request and here are 3 designs proposed regarding a secondary support system. One of them use a bolt installed the same way as a transformer mounting bolt and 2 others use lag bolts to be installed in the pole.

*We have made our design considering the following criterias
* Easy to install
* Low profile
* Low costing

The designs proposed can be made of galvanized steel as well as stainless steel. Obviously these designs could be improved or modified to meet your needs.

I will be waiting for your comments.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Alain R Tremblay"
To: "Rose, Clifton"
Date: 2011/06/06 15:46:37
Subject: RE: Transformer Hanger Brackets

Bonjour Cliff,

Please see my comments below en red.

I will be waiting for additional comments.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: "Alain R Tremblay"
Date: 2011/06/06 14:44:28
Subject: RE: Transformer Hanger Brackets

Hi Alain,

Here are a couple preliminary comments on the designs:

Option 1 would need to be large enough or high enough to allow the bolt hole to be drilled from the transformer side of the pole. Otherwise, it would be difficult to get the hole to align by drilling from the backside of the pole.

Yes I agree. Is it possible to get the distance needed above the cover to be able to drill the hole ?

Would Option 2 and 3 restrict lateral movement in the event that the bracket separates?

No. If you need the restriction of lateral movement these designs should be improved or eliminated.
I am seeking additional comments from our people and will advise you accordingly.

Regards,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2011/06/10 12:03:52
Subject: RE: Transformer Hanger Brackets
Attachments: Secondary Support System OPTION #1-R01.pdf
Secondary support system Assembly.pdf

Bonjour Cliff,

I've made a change on my drawing for Option #1
I've made the feature longer to allow drilling the hole in the pole above the cover.
Please look at the drawing and let me know your comments.
I've represented both cases, one with the top bracket at 100mm from top of tank and other with the bracket at 150mm from top of tank.

On the worst case (bracket at 150mm) your staff get 38mm (1 1/2") clearance above the cover to drill the hole. For the other case (bracket at 100mm) your staff get 88mm (3 1/2") clearance.

Obviously the feature could be longer as per your needs.

I'm still trying to find a way to restrict the lateral movement for Option #2
Any ideas to improve those designs would be welcome.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Alain R Tremblay
To: "Rose, Clifton"
Date: 2011/06/28 17:16:19
Subject: RE: Transformer Hanger Brackets

Hi Cliff,

Yes it is possible to make samples for a trial installation. As I mentionned earlier we need to have 2 differents designs. One for Frameco's tank and one for J.L. Leclerc's tank. How many samples would you like to get ? Would you like to try both design ?

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering

Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2011/06/28 14:53:59
Subject: RE: Transformer Hanger Brackets

Hi Alain,

Using a bolt through the pole appears to be the more favourable option. Would it be possible to have one or more samples of Option #1 for a trial installation?

Regards,
Cliff

From: "Rose, Clifton"
To: "Alain R Tremblay"
Date: 2011/06/29 08:58:51
Subject: RE: Transformer Hanger Brackets

Hi Alain,

Maybe we could try a few samples of each design. I'd like to get feedback from our guys in the field after installing the samples.

Thanks,
Cliff

From: "Alain R Tremblay"
To: "Rose, Clifton"
Date: 2011/09/01 15:33:12
Subject: RE: Transformer Hanger Brackets

Bonjour Cliff,

Sorry for the delay. I have made the trial and everything looks good. I have included some pictures attached.

I'm going to proceed with the order of 5 samples of each design.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Alain R Tremblay"
To: "Rose, Clifton"
Date: 2011/10/03 17:15:35
Subject: RE: Transformer Hanger Brackets Secondary Support

Bonjour Cliff,

I have received the samples
* 5 samples to be used with Frameco's tanks
* 5 samples to be used with JL Leclerc's tanks.

Do you have the address and the name of the person for shipping the parts ?

Regards
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: "Alain R Tremblay"
Date: 2011/10/06 10:33:49
Subject: RE: Transformer Hanger Brackets Secondary Support

Hi Alain,

Sorry for the delay in responding. I was out of the office delivering training this week.

You can ship the samples to me at:

Newfoundland Power Inc.
30 Goff Avenue
Carbonear, NL A1Y 1A6

Thanks,
Cliff

From: alain.r.tremblay@ca.abb.com
To: "Rose, Clifton"
Date: 2011/10/06 14:46:38
Subject: RE: Transformer Hanger Brackets Secondary Support

Hi Cliff,

Parts will be shipped to your attention.

Thanks,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: said.a.anebri@ca.abb.com
Date: 2011/12/14 10:48:28
Subject: Transformer Bracket Failure

Hi Said,

Just a note to advise you of another failure we've experienced with the hanger brackets on ABB stainless steel transformers. The unit is a 50 kVA manufactured 05-2003, serial number AB1025497-006 and fell from the pole during a recent wind storm. Fortunately, the transformer did not hit the ground, but hung up on the communications cable.

Regards,
Cliff

From: "Said A Anebri"
To: "Rose, Clifton"
Date: 2011/12/15 20:50:23
Subject: Re: Transformer Bracket Failure

Hello Clifton,

Not a nice picture by any means. Looking at it makes me feel unsafe; this could result in a serious injury!! Fortis Newfoundland Power needs to start (very quickly) the installation and testing the new support system Assembly that we have designed for you.

Please let us know if we may be of further assistance.

Best regards,

Said Anebri, M.Sc., Eng.
Head of Marketing/ Chef du département marketing
Distribution Transformers Division /Division Transformateurs de distribution
500 rue du Binôme.
Québec G1P 4P1
Telephone : + 1 418-650-7635
Cell:+ 1 418-956-2575
email: said.a.anebri@ca.abb.com

From: "Rose, Clifton"
To: alain.r.tremblay@ca.abb.com
Date: 2012/01/26 12:21:19
Subject: RE: Transformer Hanger Brackets Secondary Support

Hello Alain,

We completed a trial installation of the support bracket last week at our Carbonear facility. The trial was completed using a 25 kVA transformer and we received the following comments:

· The crew had difficulty getting the support bracket up through the existing hanger bracket due to tightness with the cover and the nameplate rivets.

· Bolts need to be ½" longer.

· Slotted holes would allow for more movement/adjustment.

· The time to change out the transformer is not much different than the time to install the support bracket.

In view of the comments received, we are thinking that it may be best to have the transformers in the field replaced. The removed transformers would then be repaired in the shop using reinforcing brackets as per previously repaired transformers that were held in stores. The removed transformers could be repaired by our people or at a repair shop. The costs of a repair program may not cost much more than a program to install the support bracket and would eliminate this interim step.

I will advise you when a decision is made on the direction chosen to correct this issue.

Regards,
Cliff

From: "Alain R Tremblay"
To: "Rose, Clifton"
Date: 2012/01/31 10:43:55
Subject: RE: Transformer Hanger Brackets Secondary Support

Hello Cliff,

Thanks for this update.
We will be waiting for for your decision.

Should you need some help or advice please let me know.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021

email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: Alain R Tremblay/CATRM/ABB@ABB
Date: 2012-04-12 09:41 AM
Subject: Support Brackets

Good Morning Alain,

We completed a test installation of the transformer support bracket that you supplied. Based upon the time required to install the bracket in the field, it was suggested by our line staff that it would be just as quick to change out the transformer. However, where we have transformers installed in back lot construction, changing out the transformer is not as feasible. In these cases we are looking at options that would address the issue and prevent the transformer from falling.

I have taken your drawing of the top reinforcing bracket assembly and modified it for discussion purposes. The modified drawing of the top bracket is attached. Would it be possible to modify the design of the reinforcing bracket, as shown to make it easier to install in the pole? The dimensions of the reinforcing bracket could be different than shown. Our suggestion is to enable the bracket to be bolted to the existing hanger bracket without drilling or punching the existing bracket.

If this were an alternative, would installing reinforcing brackets on top and bottom hanger brackets be required?

Please review this suggestion and provide your comments.

Regards,

Cliff

From: Alain R Tremblay
To: Rose, Clifton
Sent: April 13, 2012 4:27 PM
Subject: Re: Support Brackets

Bonjour Cliff,

After reviewing your suggestion here are my comments.

Using the reinforcing bracket as per your suggestion would certainly prevent transformer from falling. Depending on your needs you can use one or two reinforcing bracket.
* Using a reinforcing bracket on top. This option would prevent transformer from falling but I'm not sure would prevent distortion or damage on the lower bracket.
* Using two reinforcing bracket one on top and one on lower bracket. This option ensure lateral stability of the transformer and eliminate risks of damage on both mounting brackets.
I like your idea. It's a good idea but I need to verify with our supplier if this style of bracket is feasible. I will verify and I will let you know as soon as possible.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: Alain R Tremblay
Date: 2012-04-16 07:53 AM
Subject: RE: Support Brackets

Good Morning Alain,

As another suggestion, if it is easier for manufacturing, the bracket could be made wider as one piece. Rather than the 102 mm width with added portions for the bolts, it could be say 152 mm wide or whatever the dimension needs to be to accommodate the bolts.

Regards,

Cliff

From: Alain R Tremblay/CATRM/ABB
To: "Rose, Clifton"
Date: 2012-04-16 09:30 AM
Subject: RE: Support Brackets

Good morning Cliff,

I have noted your suggestion. I'm going to veriify with our tank manufacturer what is the easier way to manufacture the plate.

Regards,

Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: Alain R Tremblay
To: Rose, Clifton
Sent: May 1, 2012 10:36 AM
Subject: RE: Support Brackets

Good morning Cliff.

The manufacturer can make both design. Here are the drawings. Please let me know what would be the next steps.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: Alain R Tremblay
Date: 2012-05-01 12:38 PM
Subject: RE: Support Brackets

Hello Alain,

I suspect that Proposal #1 may be easier to install in the field where the bracket is close to the cover of the tank, but not as easy to manufacture. Could we get a few samples of each complete with the inner plates and bolts to test install in the field? I would also like samples of the bottom bracket to be included as well.

Following the trial installation, we will select a design and propose that all units in the field be reinforced with the brackets.

Regards,
Cliff

From: Alain R Tremblay
Sent: May 1, 2012 3:07 PM
To: Rose, Clifton
Subject: RE: Support Brackets

Hello Cliff,

I agree with your comments and a trial installation would answer the question. I understand you would like to get bottom brackets as per the original design. Am I ok ?

How many complete set of samples would like to get ?

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: Alain R Tremblay
Date: 2012-05-01 02:18 PM
Subject: RE: Support Brackets

Alain,

The bottom brackets would have to be similar to the new design upper brackets with the bolts outside the existing transformer bracket. We would want to install both upper and lower brackets without having to drill the existing brackets. Three or four sets of brackets would be sufficient for a trial installation.

Regards,
Cliff

From: Said A Anebri
Sent: May 10, 2012 12:55 PM
To: Rose, Clifton
Cc: Alain R Tremblay
Subject: Re: Fw: Support Brackets

Hello Cliff,

As per our discussion we had last Tuesday, the initial cost for four sets of brackets (upper brackets& lower brackets) is 4x $225 (includes cost for set up) = $900 EXW Quebec Factory, (we will still do everything possible to ship the brackets with your new transformers so that we can save you the cost of transportation).

As per our supplier comments, the unit price for these set of brackets after the initial order should be around 50$ +Taxes+ freight.
Please not that we haven't charged Fortis NFP ABB's design costs.

If you are agreeable, please send us your PO so that we can order these sets of brackets for you.

I will remain at your total disposal if you have any further questions

Best regards,
Said Anebri, M.Sc., Eng.

Head of Marketing/ Chef du département marketing
Distribution Transformers Division /Division Transformateurs de distribution
500 rue du Binôme.
Québec G1P 4P1
Telephone : + 1 418-650-7635
Cell:+ 1 418-956-2575
email: said.a.anebri@ca.abb.com

From: "Rose, Clifton"
To: Said A Anebri
Cc: Alain R Tremblay
Date: 05/10/2012 01:11 PM
Subject: RE: Fw: Support Brackets

Hi Said,

Would you send me drawings for both upper and lower brackets complete with the associated hardware for the complete installation? After receipt of the drawings, we will decide to either have Purchasing issue a PO or use a Visa number, if that is an option.

Regards,
Cliff

From: Said A Anebri/CAABB/ABB
To: Alain R Tremblay/CATRM/ABB@ABB
Cc: "Rose, Clifton"
Date: 2012-05-10 01:17 PM
Subject: RE: Fw: Support Brackets

Alain, please send Cliff the requested drawings ASAP.

Best regards,

Said Anebri, M.Sc., Eng.
Head of Marketing/ Chef du département marketing
Distribution Transformers Division /Division Transformateurs de distribution
500 rue du Binôme.
Québec G1P 4P1
Telephone : + 1 418-650-7635
Cell:+ 1 418-956-2575
email: said.a.anebri@ca.abb.com

From: Alain R Tremblay
To: Rose, Clifton
Sent: May 11, 2012 10:55 AM
Cc: Said A Anebri
Subject: RE: Fw: Support Brackets

Hello Cliff,

Please find drawings attached for Frameco brackets.
For JL Leclerc brackets drawings and price will be the same except for bracket dimensions that will be a little differents to fit the brackets.

Regards
Alain Tremblay
Concepteur Mécanique - Mechanical Designer

PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: Alain R Tremblay
Cc: Said A Anebri
Date: 05/18/2012 10:21 AM
Subject: RE: Fw: Support Brackets

Hello Alain,

As per my conversation with Said, we wish to receive samples of the brackets for review and a trial installation. The samples as per the drawings will be acceptable.

Regards,

Cliff

From: Said A Anebri
To: Alain R Tremblay
Cc: "Rose, Clifton"
Date: 2012-05-18 11:08 AM
Subject: RE: Fw: Support Brackets

Alain, as an exception, we will absorb the charge for these four samples of the bracket so please order them ASAP.

Thanks & Best regards,
Said Anebri, M.Sc., Eng.
Head of Marketing/ Chef du département marketing
Distribution Transformers Division /Division Transformateurs de distribution
500 rue du Binôme.
Québec G1P 4P1
Telephone : + 1 418-650-7635
Cell:+ 1 418-956-2575
email: said.a.anebri@ca.abb.com

From: Alain R Tremblay
To: "Rose, Clifton"
Cc: Said A Anebri
Date: 2012-06-06 12:00 PM
Subject: RE: Fw: Support Brackets

Bonjour Cliff,

The brackets have been ordered and will be delivered at our facilities on June 20th

I'll contact you for the shipment of the parts at your facilities at this moment.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: Alain R Tremblay
To: Rose, Clifton
Sent: June 28, 2012 4:04 PM
Cc: Said A Anebri
Subject: RE: Fw: Support Brackets

Bonjour Cliff,

I received 4 samples today. Our supplier made a very good job with laser cut technology. Parts are very, very clean.

So the parts are ready to ship. Could you please send the shipping address.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: Alain R Tremblay/CATRM/ABB@ABB
Cc: Said A Anebri/CAABB/ABB@ABB
Date: 2012-06-28 02:37 PM
Subject: RE: Fw: Support Brackets

Hello Alain,

Please send the brackets to me at:

Newfoundland Power Inc.
30 Goff Avenue
Carbonear, NL A1Y 1A6

Regards,
Cliff

From: Alain R Tremblay
To: Rose, Clifton
Sent: July 5, 2012 3:02 PM
Cc: Said A Anebri
Subject: RE: Fw: Support Brackets

Hello Cliff,

The brackets are shipping today by Fedex to your attention. The tracking number is 511707652010

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

From: "Rose, Clifton"
To: Alain R Tremblay
Cc: Said A Anebri
Date: 2012-07-12 10:00 AM
Subject: RE: Fw: Support Brackets

Hi Alain,

I have received the brackets and they look good. We will arrange a trial installation to receive comments from our field people.

Regards,
Cliff

From: "Alain R Tremblay"
To: "Rose, Clifton"
Date: 2012/07/12 12:07:01
Subject: RE: Fw: Support Brackets

Hi Cliff,

I've tried the brackets and they were fitting the size of the brackets very well. Please keep me informed about the trial installation.

Regards,
Alain Tremblay
Concepteur Mécanique - Mechanical Designer
PTTR / Ingénierie - Engineering
Tel / Phone: 418 650-7660
Fax: 418 650-2021
email:alain.r.tremblay@ca.abb.com

Metallurgical Report
Failure Analysis of a Transformer Bracket

METALLURGICAL REPORT

FAILURE ANALYSIS OF A TRANSFORMER BRACKET

CLIENT: **A.B.B. INC.**
500, du Binome
Québec (Québec) G1P 4P1

Att. : Mr. Alain Tremblay

Order n° : **--**

Date : January 6th, 2004
File n° : QC-03150-01
O/ Reference n°: XX-03002-98
Number of pages : 18 (including annexes)

Prepared by:

Myriam Brochu, Eng., M.Sc.A
Metallurgist

Approved by:

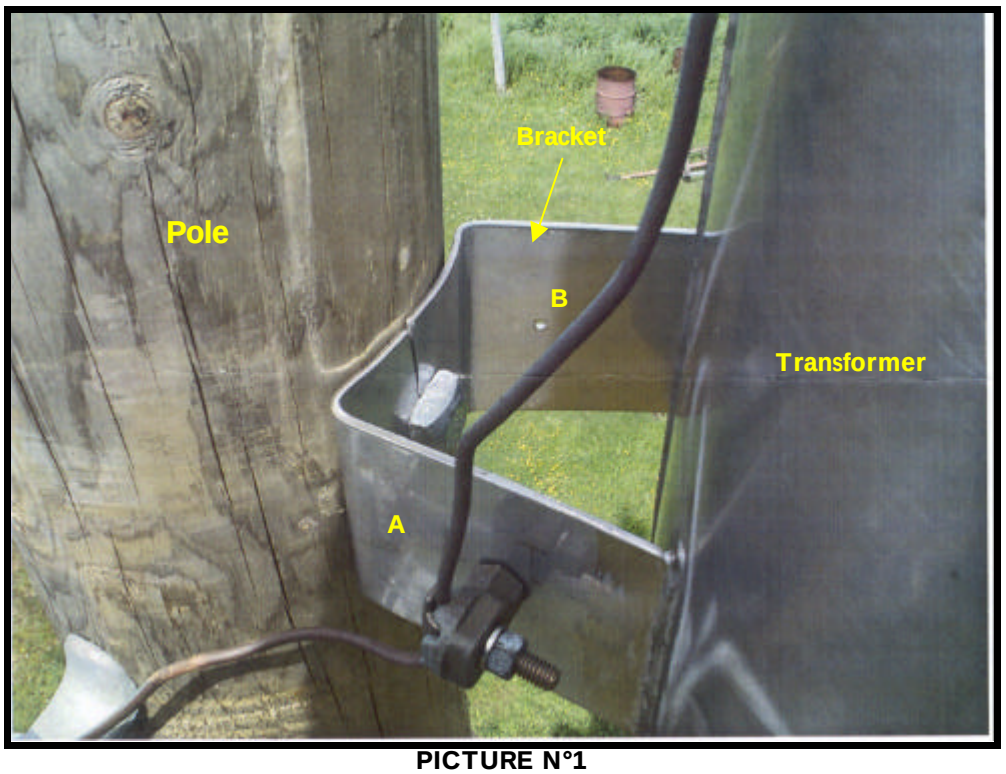
Patrick Beck, Eng., M.Sc.A
Manager, Metallurgical Dept.

SUMMARY

A transformer bracket was sent to X-PER-X for a failure analysis. The part failed prematurely, five months after its installation. A.B.B., the bracket and transformer manufacturer, gave us the mandate to identify the most probable cause of rupture. The investigation was performed in many steps, which are: material characterization, macroscopic and microscopic observations. The material from which the bracket is fabricated was identified as stainless steel 316L. Analysis revealed that its chemical composition and its hardness are in accordance with general specification given in ASTM A666-94 standard. Macroscopic observations made it possible to state that the part failed in two steps under dynamic solicitation. Microscopic observations gave many indications that bolt tightening probably accelerated failure. Many cracks initiated around the bolt hole. Moreover, the bracket was scratched and deformed in that specific area. Finally, vibrations are probably responsible for fatigue propagation of the cracks. In the future, it is recommended to use a washer between the bolt and the bracket to give a more uniform tightening. A maximum tightening torque should also be proposed by design engineers.

1.0 INTRODUCTION

The part sent for metallurgical expertise is a metallic mounting bracket used to hang a distribution transformer to a wood pole (Picture n°1).



PICTURE N°1
System Overview

According to A.B.B., transformer and bracket manufacturer, transformer itself weights about 350 kg. It is supported by two brackets as shown on figure 1. It was also explained that the upper bracket usually supports the transformer weight and the lower one minimizes the lateral movements.

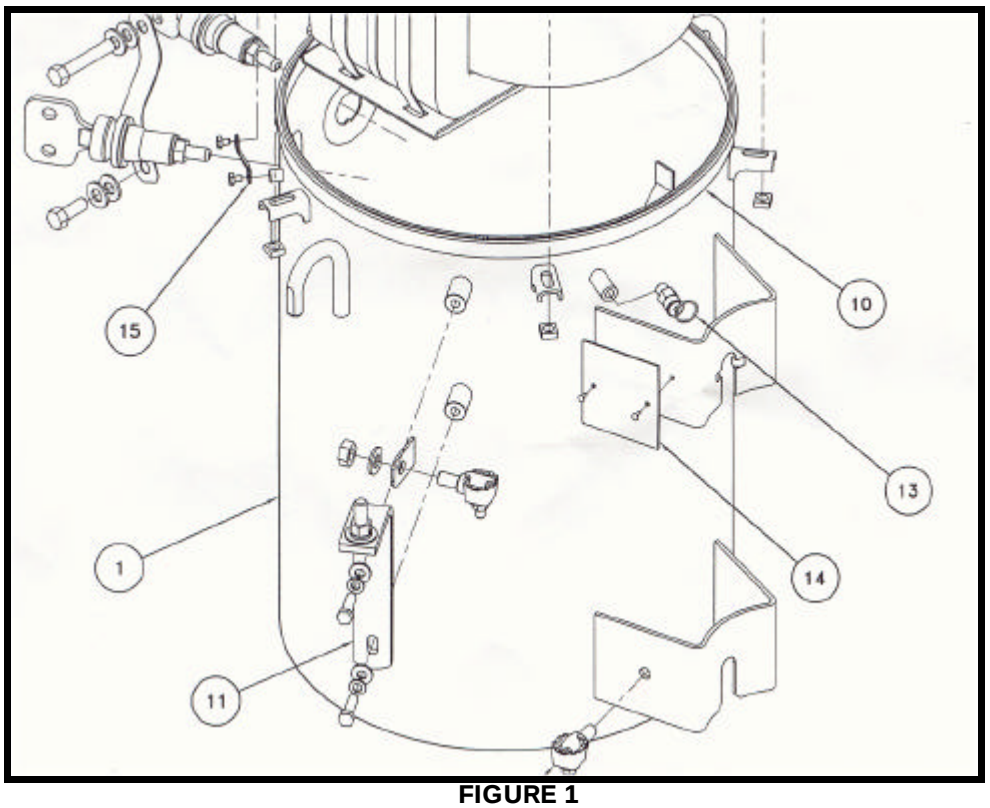


FIGURE 1
Lower Portion of the Transformer Assembly Drawing

Five months after the transformer was installed, the lower bracket failure was observed by A.B.B.'s client (Picture n°1). This was considered a case of premature failure. X-PER-X mandate is thus to identify the most probable cause of failure. This mandate was given by A.B.B. inc., which needs to answer their client's worries about the product.

The metallurgical investigation will be performed in two steps. First of all, the bracket material and dimensions will be characterized to check if it is in accordance with design specifications. Secondly, the failure sequence and fracture mode will be determined by studying the ruptured surfaces using low and high magnification microscopes. With this information, it will be possible to make hypothesis concerning the cause of rupture. Recommendations will also be formulated to avoid similar failure in the future.

2.0 DESIGN SPECIFICATION

The mounting bracket must be made according to drawing N°1104041222/226 specifications (Figure 2). It can be noticed from the item description that five different parts can be made by changing the material and the sheet thickness.

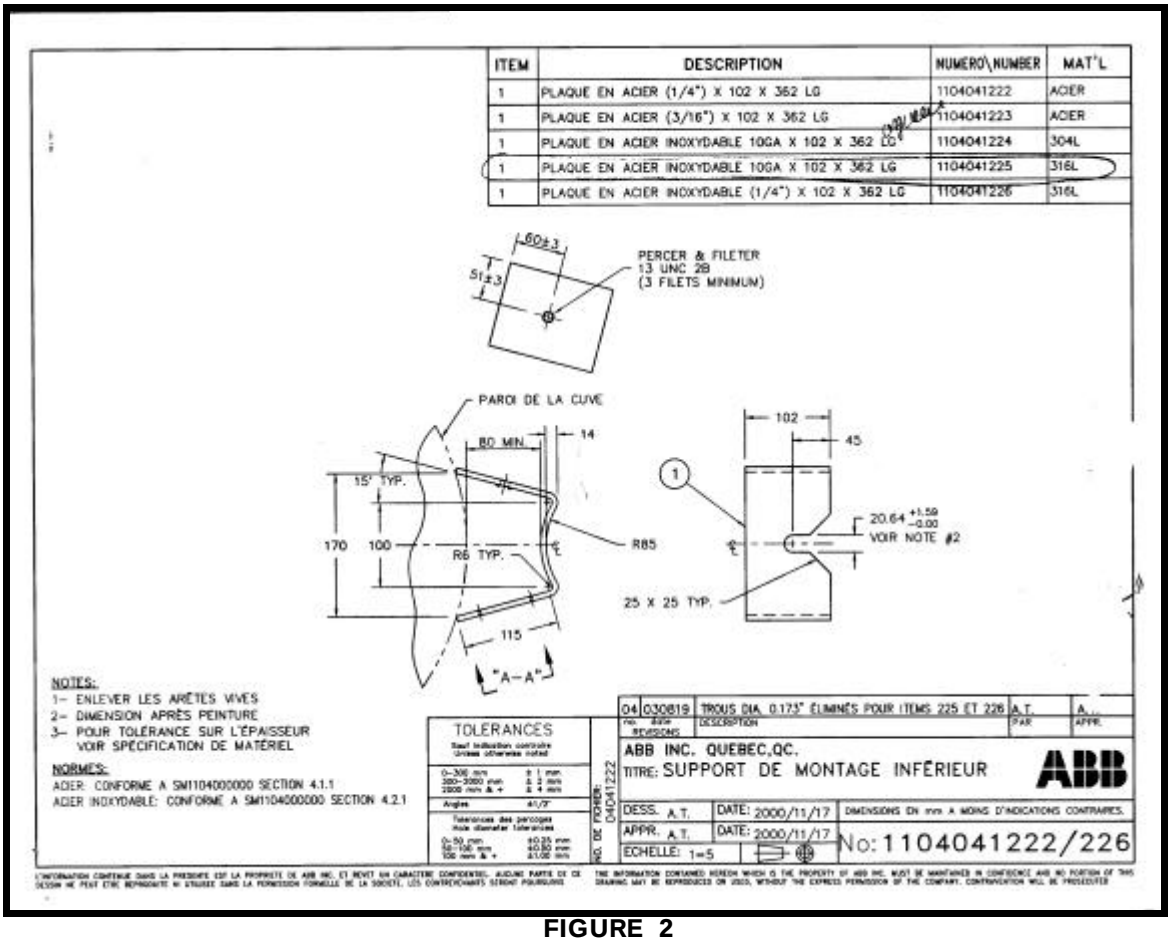
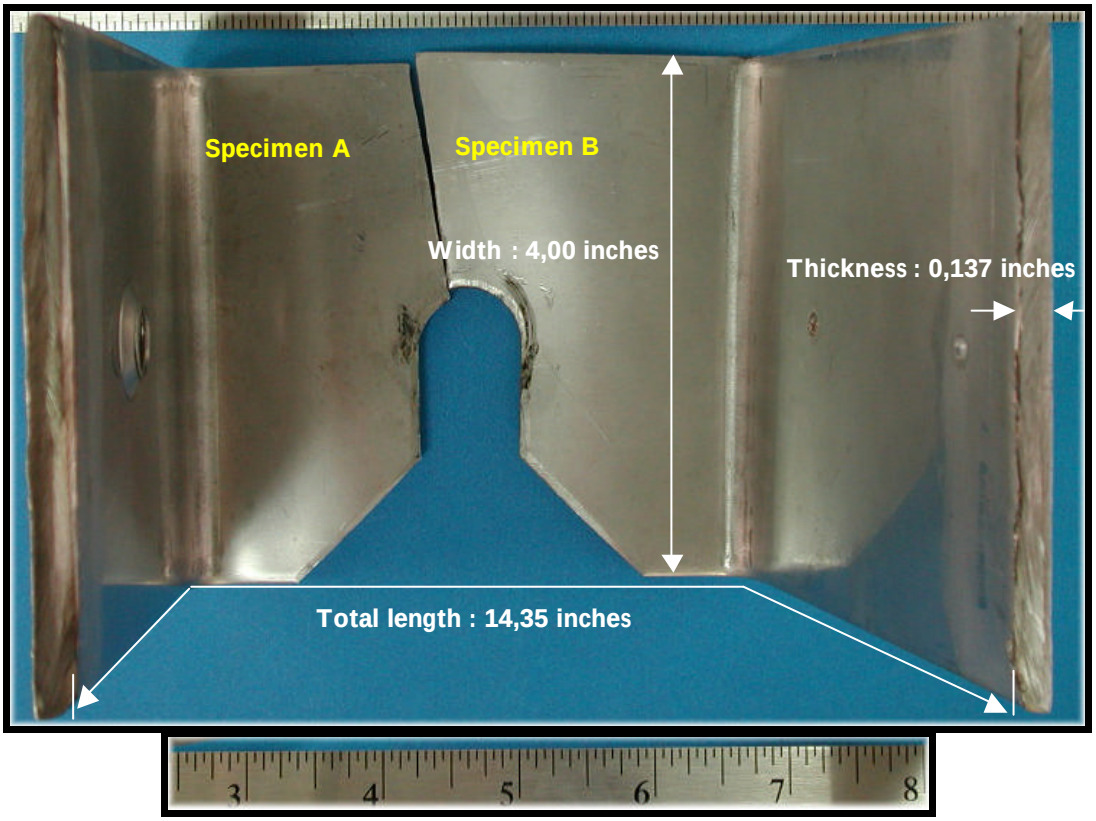


FIGURE 2
Brackets Technical Drawing

According to the mill test furnished by A.B.B., the sheet metal used to fabricate the studied sample is type 316L stainless steel gage 10. Hence, the sample part number would be 1104041225.

2.1 Dimensions

The sample width, thickness and overall length were measured to compare with the drawing specifications. Results are presented on picture n° 2 and in table 1 .



PICTURE N° 2
Sample Dimensions

TABLE 1 Sample Dimensions

	Thickness	Width (in)	Total Length (in)
Sample	0,137 in	4,00 in	14,35 in
Drawing	10GA = 0,135 in	102 mm = 4,02 in	362 mm = 14,25 in

Those dimensions are in accordance with the drawing. It was however not possible to measure precisely the other specified dimensions since X-PER-X does not have the appropriate tools and set up.

2.2 Material

Part number n° 1104041225 must be made from grade 316L stainless steel. ASTM A666 standard gives chemical and mechanical specification, which apply to austenitic stainless steel sheet, strip, plate and flat bar. In this section, chemical analysis and hardness tests were performed on the sample and results were compared with the standard and the mill test.

2.2.1 Chemical Analysis

The method used for chemical analysis is optical spectroscopy. Results were gathered from three spots each having a surface of about one square inch. The average measurements are presented in table II.

TABLE II Chemical Analysis and Apecification for Grade 316L Stainless Steel

	C	Mn	P	S	Si	Cr	Ni	Mo
Sample	0,03	1,28	0,038	0,009	0,40	15,8	10,8	2,07
Mill Test	0,016	1,86	0,026	0,002	0,51	16,7	10,5	2,04
ASTM A666-94a	0,030 max	2,00 max	0,045 max	0,030 max	0,75 max	16,00 – 18,00	10,00 – 14,00	2,00 – 3,00

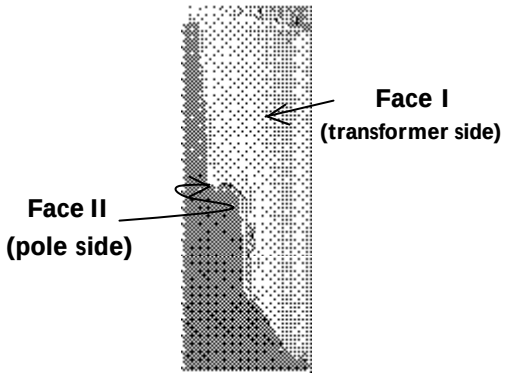
The samples chemical composition differs slightly from the mill test results and the standard specifications. Chrome content is too low by 0,2%. This difference is not significant and will not affect the material mechanical resistance. It must also be stated that the chemical analysis covers a small area compared with the rough product dimensions.

2.2.2 Hardness Measurements

To complete material characterization, Rockwell B hardness tests were performed on the specimen surfaces. Results are shown in table III and picture n° 3.

TABLE III Hardness Test Results

SPECIMEN B HRB		ASTM A 666-94a	
Face I	**Face II**		
86,0	84,5		
85,0	84,5		
86,2	85,5		
Average 85,7	**Average 84,8**	**95 HRB max**	**PICTURE N° 3** Location of Hardness Measurements



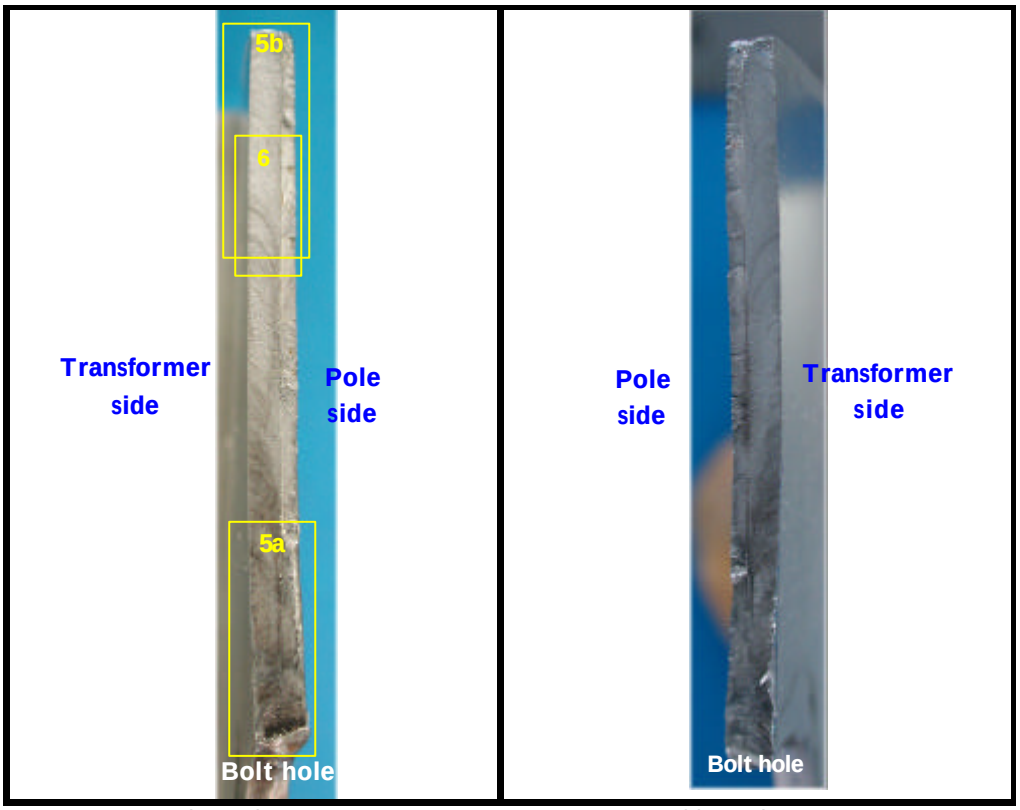
The sample has an average hardness of 85 HRB, which is in accordance with the maximum hardness specified by ASTM A666-94 standard for annealed 316L. Moreover, the results are homogeneous from one sheet side to another.

3.0 EXAMINATION OF THE RUPTURED SURFACES

The sample sent for analysis broke through its thickness has shown on picture n° 2. It is thus composed of two halves, which were identified as specimen A and specimen B. In this section, both specimens will be observed in details to reveal indications leading to failure explanation. These observations will be performed using a variety of techniques and sample preparations.

3.1 Macroscopic Observations

Both parts have a fractured surface containing similar informations since one is a mirror image of the other (Pictures n° 4).



a) Specimen A b) Specimen B

PICTURES N° 4 (2.3 X)
General View of the Fractured Surfaces

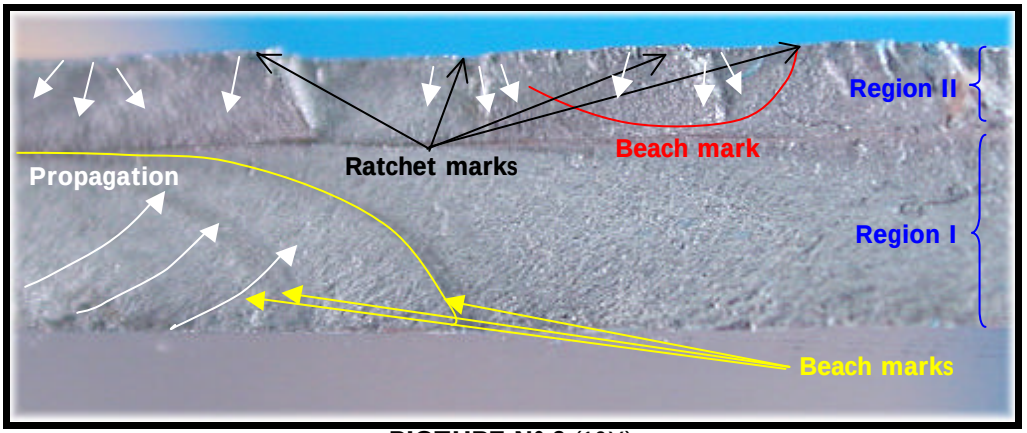
Preliminary observations of the ruptured surfaces gave much information. First of all, both surfaces show two distinct regions dividing the plate thickness. The region emerging to the plate surface transformer side, is called region I. The region emerging to the plate surface pole side, is called region II (See pictures n°1 and n° 3 for general views). It can be noticed that region II makes about half the plate thickness near the bolt hole (Bottom of pictures n° 4.) However, at the top of the pictures it makes about ¼ of the plate thickness. This can clearly be observed from pictures n° 5 taken at higher magnifications.

a) Near the Bolt Hole b) Upper Area

PICTURES N° 5 (3X)
Fractured Surface Extremities, Specimen A

This particularity gives an indication that the stress applied on the part was not uniform through its width. It will be discussed in more details in section 3.2.1.

Another feature that clearly characterizes the fractured surfaces is the presence of beach marks (Pictures n° 4, 5 and 6).



PICTURE N° 6 (10X)
Area Covered by Beach Marks, Specimen A

Beach marks are an undeniable indication that failure proceeded by fatigue. They are created when there is a change in the stress frequency, amplitude or mean value. Hence, it can be stipulated that the bracket was subjected to irregular dynamic stress. The stress intensity causing fatigue failure can be very low. For steel, it is estimated that any stress higher than 40% of the alloy ultimate resistance can initiate fatigue. For an annealed 316 L stainless steel plate this would be in the range of 3 400 psi.

The beach marks location and orientation also give information about the rupture propagation. On picture n° 6, beach marks are only visible in region I. However, some were also observed in region II under special illumination that could not be clearly reproduced on the pictures. In region II the beach marks orientation are as proposed by the red contour shown on picture n° 6. It can generally be stated that crack propagation is perpendicular do the beach marks. Moreover, considering the part geometry, the crack initiation sites are on the concave side of the beach marks curvature. Hence, region I failure initiated near the bolt hole but region II failure initiated at many places along the plate outer surface. The presence of many ratchet marks originating from the plate pole surface supports this statement.

Another information that is revealed by the beach marks concerns failure sequence. It is most probable that region II failed before region I. This can be explained by the fact that beach marks observed in region I do not go through the plate thickness. They are asymptotic to region II. In fact, crack propagation was probably retained by the biaxial state of stress developed in front of crack II.

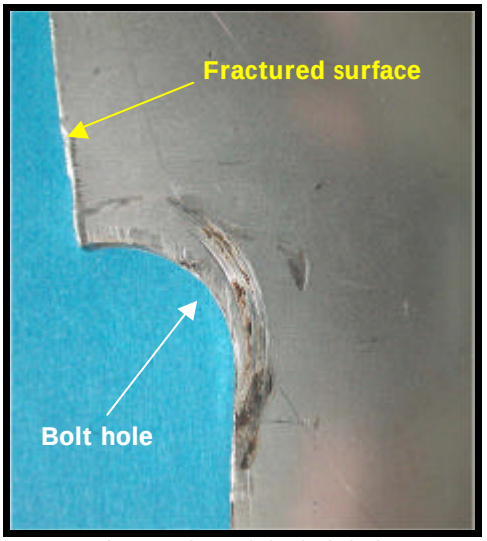
Overall, the macroscopic observation of the ruptured surfaces makes it possible to state that failure proceeded in two steps. Many cracks first initiated from the plate pole surface (region II). They propagated through the plate thickness under a dynamic stress. This failure initiation probably weakened the part by reducing its bearing section leading to the initiation

of another main crack. That second crack also propagated by fatigue but initiated at the root of the bolt hole. In the next section, deeper investigation will be done to identify the most probable cause of rupture.

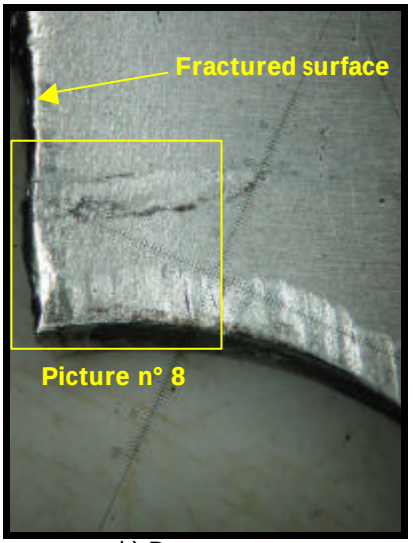
3.2 Stereoscopic and Microscopic Observations

3.2.1 Stereoscopy

Stereoscopic observations were made using magnifications between 10 and 63. Sample B was first examined around the bolt hole for signs of weakness. New evidences were revealed as will be described (Pictures n° 7).



a) Overview of the bolt hole

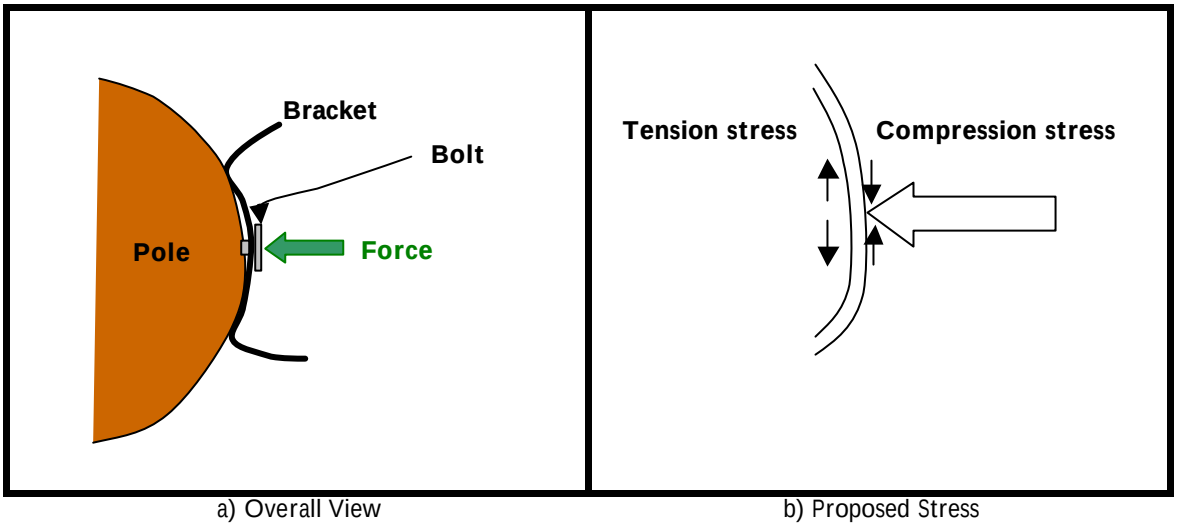


b) Damage area

PICTURES N° 7
Sample B, Transformer Side (Face I)

From pictures n° 7, one can clearly noticed that a high torque was applied to the bolt joining the bracket to the wood pole (Picture n° 1). In fact, the plate is significantly deformed and scratched (Pictures n° 7). It can also be observed that the bolt did not leave

a uniform print on the plate. This is an indication that the stress transferred to the plate was not homogeneous. Moreover, applying a high torque could have induced localized tension stress on the plate pole surface. Especially if the bracket did not exactly fits the pole shape (Figure 3).



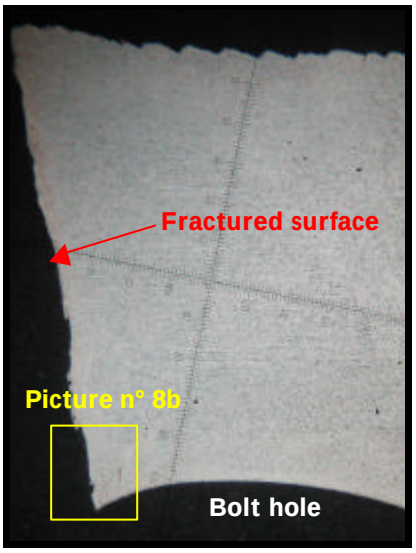
a) Overall View b) Proposed Stress

FIGURE 3
Schematic Representation of the Stress Distribution

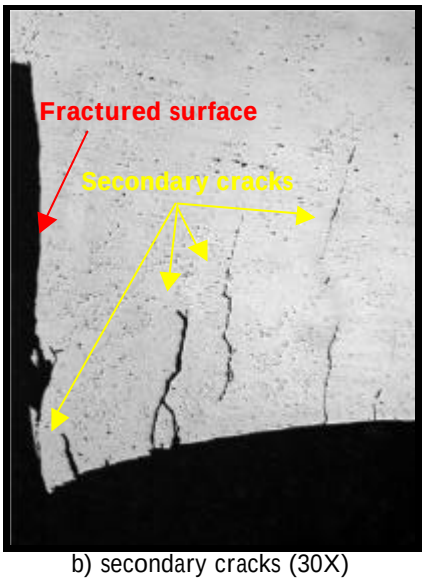
This tension stress was localized in the bolt area at the plate pole surface. This could explain the premature failure initiation. It is consistent with the fact that region II is larger near the bolt hole than in the upper region (Pictures n° 5).

3.2.2 Optical Microscopy

The scratches and deformation observed on the plate transformer side probably accelerated the second step of failure. Any surface discontinuity acts as a stress raiser from which fatigue cracks are more susceptible to initiate. To verify this hypothesis, a section was cut perpendicular to the ruptured surface and observed by optical microscopy (Pictures n° 7b and n° 8).



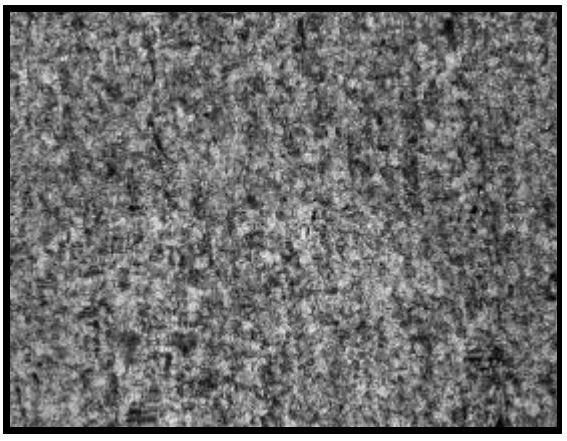
a) Sample overview (6X)



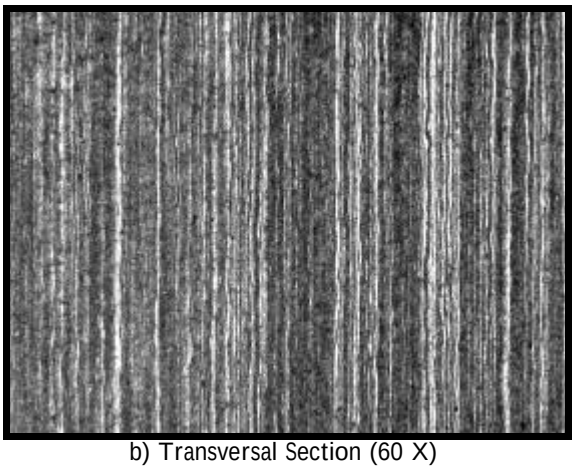
b) secondary cracks (30X)

PICTURES N° 8
Microscopic Observation of the Bolt Area, Specimen B

Many secondary cracks were observed. This is an indication that failure initiated in the bolting region. This area was highly stressed. Metallographic observations of the sample were also performed to reveal any sign of material defects (Pictures n° 9).



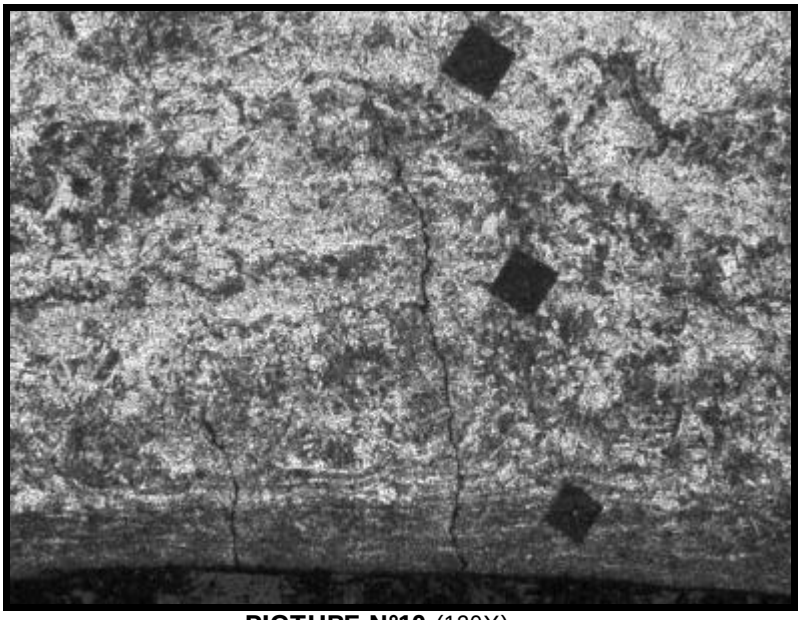
a) Plate Surface (60 X)



b) Transversal Section (60 X)

PICTURES N° 9
Specimen B Microstructure

The samples were polished and etched with marble. Their microstructure is typical of a type 316L stainless steel. It is composed of one phase only, austenite. When looking at a plan parallel to the plate surface, picture n° 9a, the grain are equiaxed and the structure is homogeneous. However, the microstructure of the transversal section bears sign of sheet forming. Its banded structure is typical of laminated products. One particularity could also be confirmed by metallographic examination. The material around the bolt hole was significantly deformed (Picture n° 10).



PICTURE N°10 (120X)
Microstructure in the Plate Plane Near the Bolt Hole

The dark colour at the bottom of the sample is created by a high grain boundary density typical of deformed areas. Microhardness tests done in that area supports this evidence (Table III).

TABLE III Microhardness Profile, Vickers 1 kg

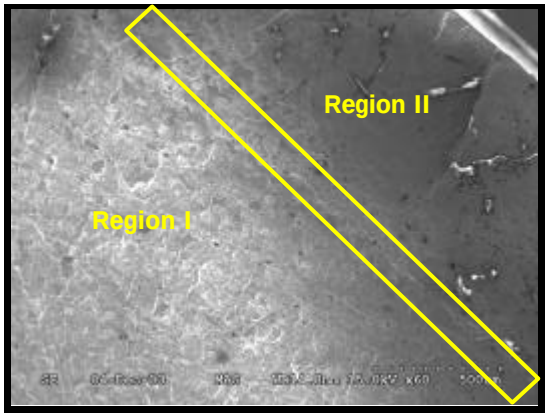
Position from the bolt hole (mm)	Hardness Vickers (HV)
0,07	360
0,32	383
0,57	278
0,82	263
1,32	226
1,82	223
2,32	212

Results shown in table III were obtained using the Vickers hardness method with a weight of 1 Kg. The tests revealed that the material is harder in the bolt area compared to the bulk sample hardness (?200 HV). Hardness usually increases in metals that have been plastically deformed. This phenomenon is called consolidation.

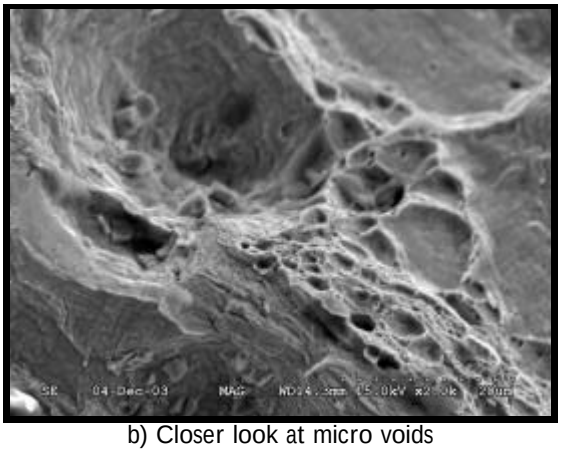
3.3.3 Scanning Electron Microscopy

Finally, scanning electron microscopy was performed to confirm rupture mode and sequence. In region II, most of the microscopic features that would have characterized the failure mode were destroyed by rub marks. This is consistent with the hypothesis that region II failed before region I. If region II had failed last, rubbing would probably not had occurred.

The existence of a region that failed under a ductile mode was also revealed by scanning electron examination. In fact, the line that separates region I from region II is entirely composed of micro voids (Pictures n° 11)



a) Micro void line between regions I and II



b) Closer look at micro voids

PICTURES N° 11
Scanning Electron Microscopy observations

Micro voids form when a ductile material is statically overstressed. This indicates that the final rupture zone is located between the two main crack front.

Overall, the microscopic observations confirmed that bolt tightening locally deformed and scratched the bracket. This event lead to premature failure since many fatigue cracks initiated around the bolt hole. Moreover, a high tensile stress was probably induced at the plate pole surface, which failed first as indicated by microscopic features. No sign of material defect were revealed which is in accordance with the analysis done in section 2.

4.0 CONCLUSION

This expertise was performed to identify the most probable cause explaining the failure of a transformer metallic bracket. The broken sample was sent by A.B.B. which is the bracket and transformer manufacturer. A.B.B. inc. explained that the part failed prematurely, five months after its installation.

The first step of the investigation consisted in sample characterisation. Chemical analysis and hardness test were performed to identify the material type. Results confirmed that the material is in accordance with design specification. It is a grade 316L stainless steel having a average hardness of 85 HRB.

Secondly macroscopic examination of the ruptured surface were performed. Many features indicated that the part failed by fatigue. Two initiation areas were identified. The first one covers a line across the plate pole surface. The second initiation site is around the bolt hole.

Microscopic examination confirmed the hypothesis that crack propagation proceeded under dynamic loading. It also revealed that bolt tightening is the most probable cause of premature fatigue initiation. This operation induced high tension stress at the plate pole surface. The bolt also significantly damaged the bracket surface.

Finally, some recommendations can be made to avoid similar failure. A washer should be installed between the bolt and the bracket to give a more uniform tightening and to protect the bracket surface. Moreover, a maximum tightening torque should be proposed by design engineers to avoid over stressing the part. Concerning the dynamic load applied on the bracket, it is probably caused by system vibration and wind. The pole on which the transformer is installed could be inspected for abnormal movement.

Minutes of Meeting March 27, 2008

Meeting ABB – Newfoundland Power

March 27th, 2008

Subject: To revise and discuss ABB's hanger transformer brackets issues as requested by Newfoundland Power.

We have listed all incidents that have been reported to ABB, we will revise each case with description of the failure and ABB's investigations and findings. We will then discuss possible failure modes and the specification used. Using more severe criteria than CSA specification ABB have evaluated the various design and will present impact. In conclusion we will recommend a solution for existing installed base.

Incident reported:

- **Complaint #014-80**

In 1999, a 50 Kva transformer made of mild steel manufactured by ABB London in 1992 fell from a pole. The hanger brackets were made of mild steel.

Actions Taken

Verification of design conformity to CSA C2.2

- With a same style tank ABB did with vertical and horizontal loading tests according to CSA C2.2, the test was successful.

Investigation

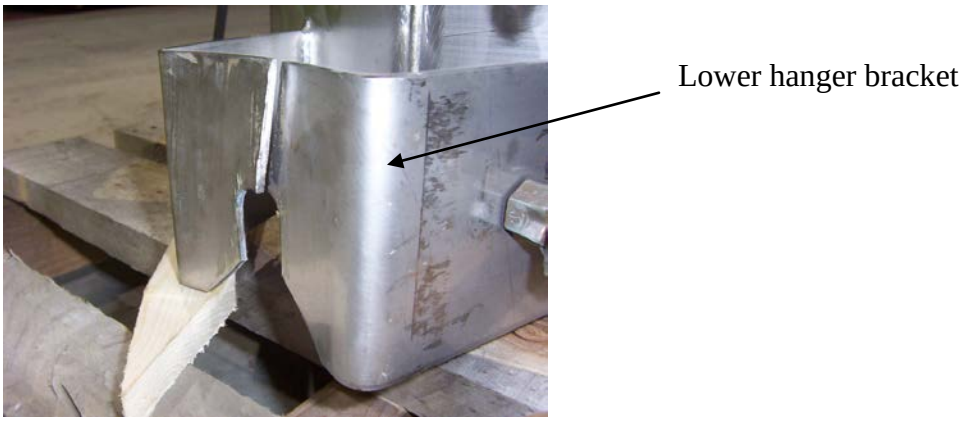
- Perform an investigation analysis on broken bracket
- Chemical analysis on steel bracket.

Conclusion

The conclusion of the investigation report made mention that a combination of factors notably cracks initiated when torquing the mounting bolts and rust in the cracks resulting of the failure of the bracket.

- **RP-91 Complaint #17616**

In July 2003, a 50 Kva transformer made of stainless steel 316L installed in February 2003 was removed with the lower hanger bracket broken. The hanger brackets were made of 10 GA (0.140") thickness SST 316L. During the same period a transformer from another supplier, installed in the same location fell from a pole.



Actions Taken

Investigation

A metallurgical report of independent experts has been issued by Laboratoire FEREX containing the following analysis:

- Metallurgical Investigation
- Study of the ruptured surfaces using magnification microscopes.
- Study of the failure sequence using magnification microscopes.

Conclusion

Metallurgical report from Laboratoire Ferex (file QC-03150-01) was issued in January 2004 with the following conclusion: the part failed by fatigue. Bolt tightening is the most probable cause of premature fatigue initiation. Bolt head also damaged the surface bracket. The report recommendations was to add a washer between the bolt and the bracket and to limit tightening torque.

ABB recommended a 55 foot/pound maximum torque by calculation and physical testing. The report also made mention of the hypothesis that a high torque was applied to the bolt which could have induced localized tension stress specially if the bracket did not exactly fits the pole shape.

- **RP-162**

In June 2006, a 50 Kva transformer made of stainless steel 316L manufactured in June 2002 having a failure at the upper mounting bracket was discovered in service and removed before a total failure of the brackets. The hanger brackets were made of 10 GA (0.140”) thickness SST 316L.The transformer was shipped back to ABB for repair. The transformer was replaced by a new one. No investigation report was performed on this specific case.

- Mr. Cliff Rose explained to ABB his concerns regarding the hanger bracket. He stated that the existing bracket design will not withstand the wind loading in Newfounland environment and asked for alternatives to this ongoing problem.

Action Taken

ABB, based on NP comments started to supply a thicker hanger bracket on transformers up to 50 Kva, no amendment has been added in Newfoundland Power specification. ABB has been supplying thicker material at the beginning of new contract in January 2007, increasing the thickness of brackets from 10 GA (0.140”) to 3/16” (0.1875”).

- **RP-216**

In October 2007, a 50 kva transformer made of stainless steel 316L manufactured in May 2002 fell from a pole. The hanger brackets were made of 10 GA (0.140”) thickness SST 316L. The investigation is under way.

Actions Taken

Investigation

A metallurgical report of independent experts has been issued by Bodycote Testing Group containing the following analysis:

- Study of the ruptured surfaces using magnification microscopes.
- Chemical analysis

Analysis report by a consultant independent engineer

- Calculation of security factors.
- Theoretical report analysis with load calculation.
- Security factors for others Kva

Verification of design conformity to CSA C2.2 by a third party.

- Vertical and horizontal loading tests according to CSA C2.2 on three (3) tanks by Bodycote successful.

Verification of design conformity to CSA C2.2 (Tests performed by ABB)

- Vertical and horizontal loading tests according to CSA C2.2 with a same style tank successful
- Vertical loading tests using 1.5 times (1600 Lbs) the CSA C2.2 required load with a same style tank successful.
- Horizontal loading tests using 1.7 times (170 Lbs) the CSA C2.2 required load with a same style tank successful.

- In February 2008, a 50 Kva transformer made of stainless steel 316L that was manufactured in March 2003 was discovered with hanger brackets failure. We can see a distortion of both hanger brackets. The hanger brackets were made of 10 GA (0.140") thickness SST 316L. ABB is waiting for more details.

- In March 2008, Mr. Cliff Rose informed ABB that those 50 Kva transformer styles (made with 10 GA hanger bracket) are now in hold in their backyard.

Failure mode analysis

- **Tightening torque on bolt**
  - Bracket distortion
  - Over and under torque used

- **Pole diameter not according to CSA 015-05 spec**
  - Pole too large deforming bracket radius
  - Pole to small inducing Cantilever effect

- **Pole stability**
  - Abnormal movement
  - Cantilever effect

- **Climatic conditions**
  - Wind condition higher than identified in specification

- **Corrosion**
  - With mild steel design

CSA requirements vs more severe criteria

- Security factors table using previous and actual design with CSA requirements and more severe criteria.

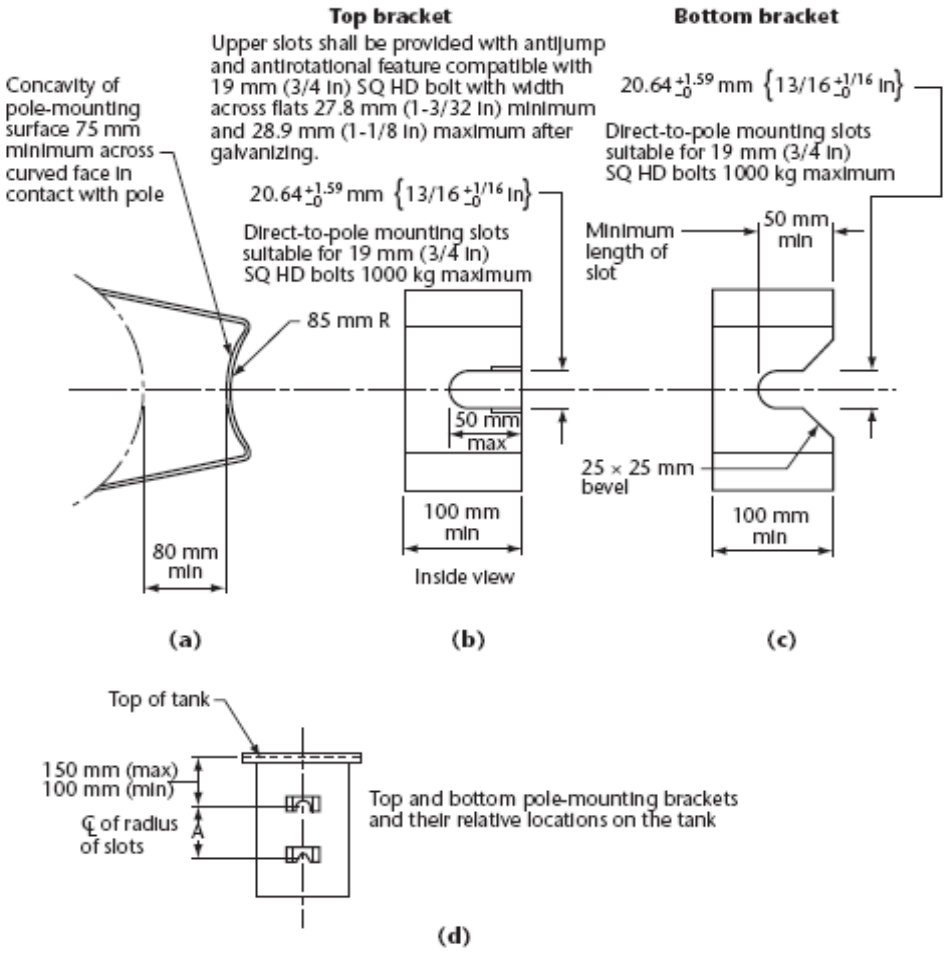
Recommendations

- Newfoundland Power must validate if CSA C2.2 specification requirements match local particular environment condition.

Conclusion

- Solution to secure transformer installed in the field.
  (See appendix 4)

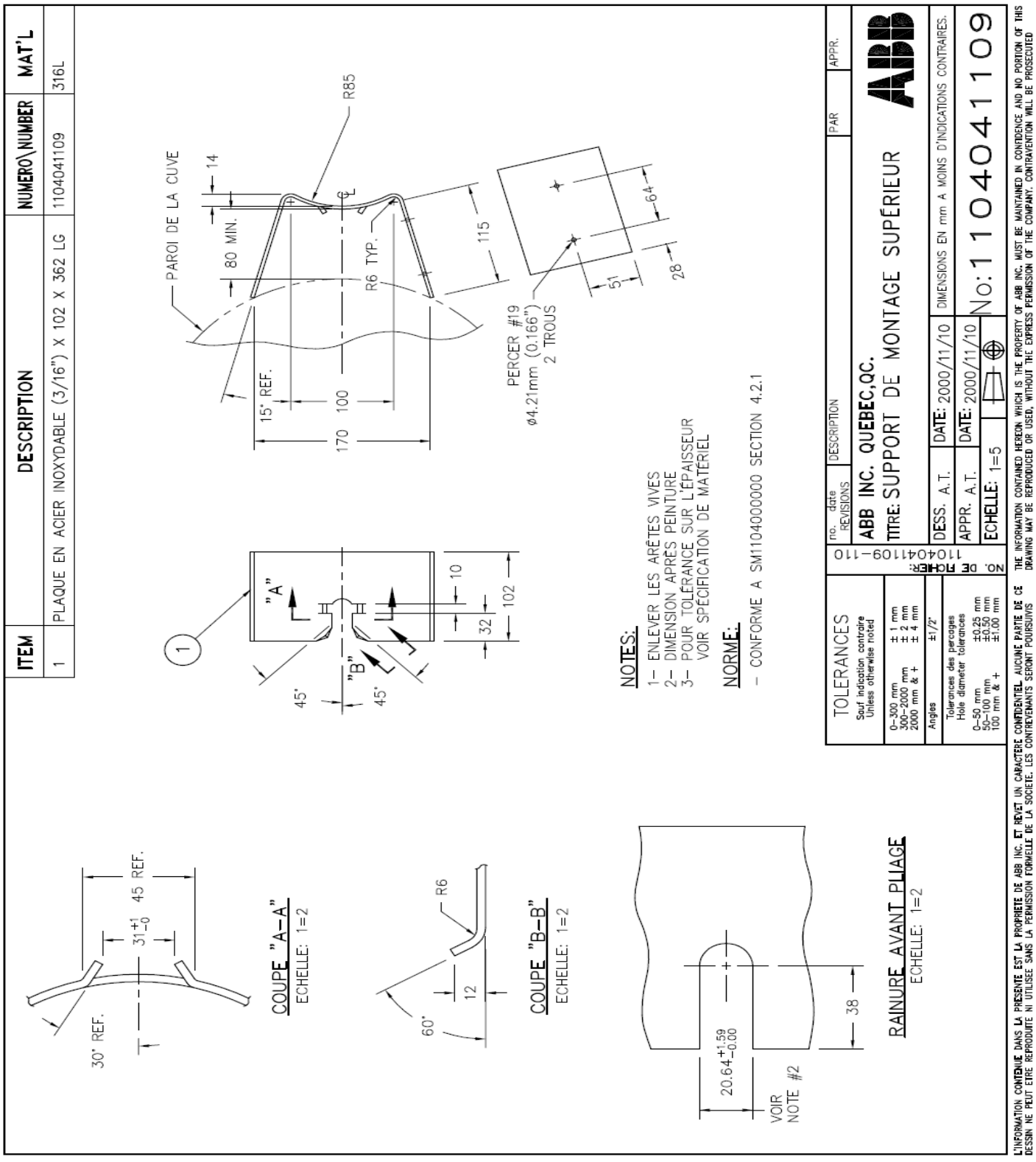
APPENDIX 1



Single-phase ratings, kV•A	A +8 −3 (mm)
10, 25	370
50, 75, 100	550
167	730

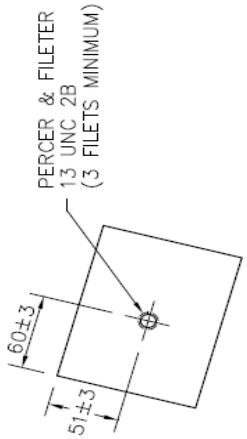
Figure 9
Direct-to-pole mounting brackets
(See Clause 8.5.)

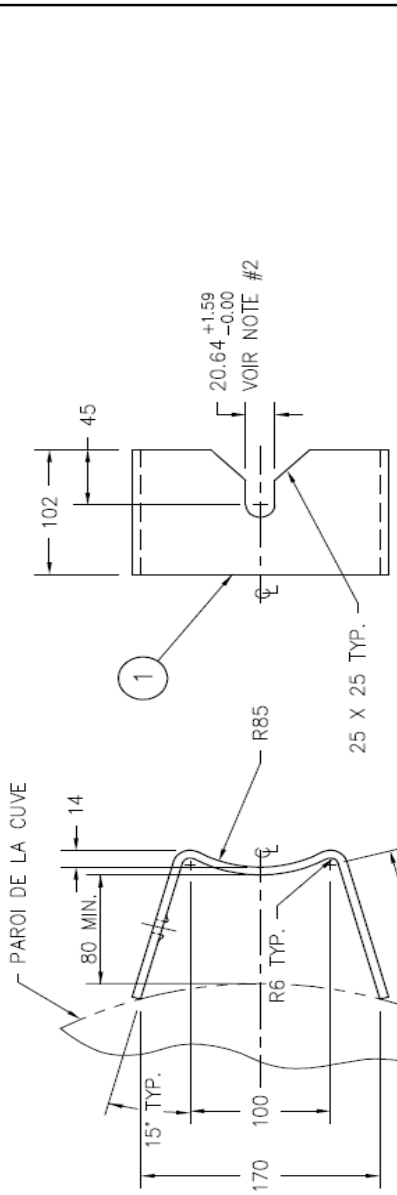
APPENDIX 2


ITEM
DESCRIPTION
NUMERO\NUMBER
MAT'L
1
PLAQUE EN ACIER INOXYDABLE (3/16") X 102 X 362 LG
1104041109
316L
PAROI DE LA CUVE
80 MIN.
14
15° REF.
170
100
R6 TYP.
R85
115
PERCER #19
ø4.21mm (0.166")
2 TROUS
64
51
28
"A"
"B"
45°
45°
10
32
102
NOTES:
1- ENLEVER LES ARÊTES VIVES
2- DIMENSION APRES PEINTURE
3- POUR TOLÉRANCE SUR L'ÉPAISSEUR VOIR SPÉCIFICATION DE MATÉRIEL
NORME:
- CONFORME A SM1104000000 SECTION 4.2.1
30° REF.
31 +1 -0
45 REF.
COUPE "A-A"
ECHELLE: 1=2
60°
12
R6
COUPE "B-B"
ECHELLE: 1=2
20.64 +1.59 -0.00
VOIR NOTE #2
38
RAINURE AVANT PLIAGE
ECHELLE: 1=2
TOLERANCES
Sauf indication contraire
Unless otherwise noted
0-300 mm ± 1 mm
300-2000 mm ± 2 mm
2000 mm & + ± 4 mm
Angles ±1/2°
Tolerances des percages
Hole diameter tolerances
0-50 mm ±0.25 mm
50-100 mm ±0.50 mm
100 mm & + ±1.00 mm
NO. DE PIÈCE
1104041109-110
no. date DESCRIPTION PAR APPR.
REVISIONS
ABB INC. QUEBEC,QC.
TITRE: SUPPORT DE MONTAGE SUPÉRIEUR
DESS. A.T. DATE: 2000/11/10
APPR. A.T. DATE: 2000/11/10
ECHELLE: 1=5
DIMENSIONS EN mm A MOINS D'INDICATIONS CONTRAIRES.
No: 1104041109
L'INFORMATION CONTENUE DANS LA PRESENTE EST LA PROPRIETE DE ABB INC. ET REVET UN CARACTERE CONFIDENTIEL. AUCUNE PARTIE DE CE DESSIN NE PEUT ETRE REPRODUITE NI UTILISEE SANS LA PERMISSION FORMELLE DE LA SOCIETE. LES CONTREVENANTS SERONT POURSUIVIS
THE INFORMATION CONTAINED HEREON WHICH IS THE PROPERTY OF ABB INC. MUST BE MAINTAINED IN CONFIDENCE AND NO PORTION OF THIS DRAWING MAY BE REPRODUCED OR USED, WITHOUT THE EXPRESS PERMISSION OF THE COMPANY. CONTRAVENTION WILL BE PROSECUTED

APPENDIX 3

ITEM	DESCRIPTION	NUMERO\NUMBER	MAT'L
1	PLAQUE EN ACIER (1/4") X 102 X 362 LG	1104041222	ACIER
1	PLAQUE EN ACIER (3/16") X 102 X 362 LG	1104041223	ACIER
1	PLAQUE EN ACIER INOXYDABLE 10GA X 102 X 362 LG	1104041224	304L
1	PLAQUE EN ACIER INOXYDABLE (3/16") X 102 X 362 LG	1104041225	316L
1	PLAQUE EN ACIER INOXYDABLE (1/4") X 102 X 362 LG	1104041226	316L





NOTES:
1- ENLEVER LES ARÊTES VIVES
2- DIMENSION APRÈS PEINTURE
3- POUR TOLÉRANCE SUR L'ÉPAISSEUR VOIR SPÉCIFICATION DE MATÉRIEL

NORMES:
ACIER: CONFORME A SM1104000000 SECTION 4.1.1
ACIER INOXYDABLE: CONFORME A SM1104000000 SECTION 4.2.1

TOLERANCES
Sauf indication contraire
Unless otherwise noted

0–300 mm	± 1 mm
300–2000 mm	± 2 mm
2000 mm & +	± 4 mm
Angles	±1/2°
Tolerances des percages Hole diameter tolerances	
0–50 mm	±0.25 mm
50–100 mm	±0.50 mm
100 mm & +	±1.00 mm

NO. DE PIÈCE: 1104041222-226

no.	date	REVISIONS	DESCRIPTION	PAR	APPR.
06	061030	ITEM #1104041225 ÉTAIT 8GA		A.T.	A.T.

ABB INC. QUEBEC,QC.
TITRE: SUPPORT DE MONTAGE INFÉRIEUR

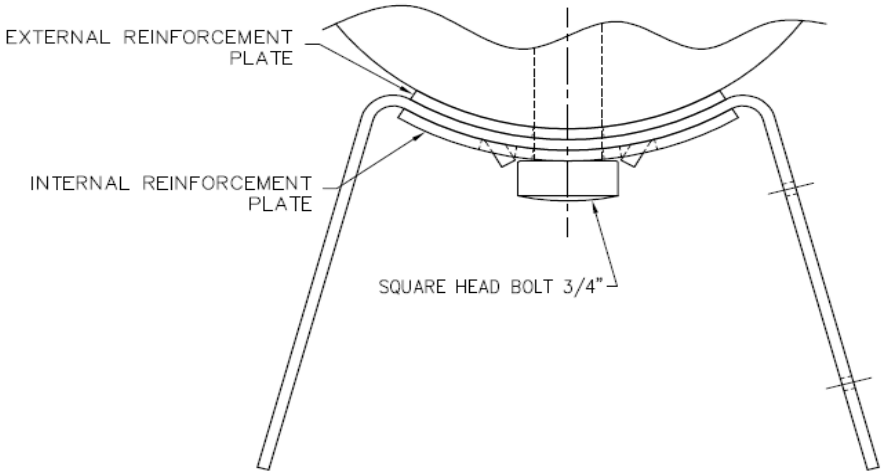
DESS. A.T. DATE: 2000/11/17
APPR. A.T. DATE: 2000/11/17
ECHELLE: 1=5

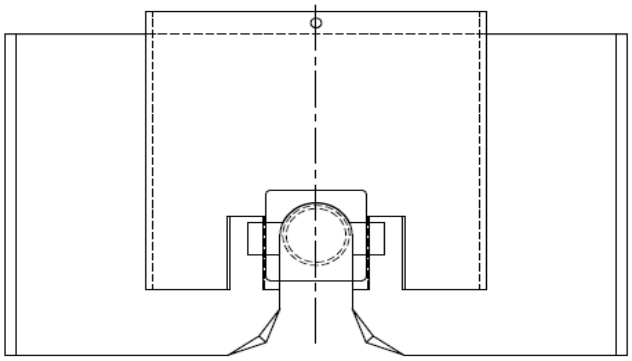
DIMENSIONS EN mm A MOINS D'INDICATIONS CONTRAIRES.

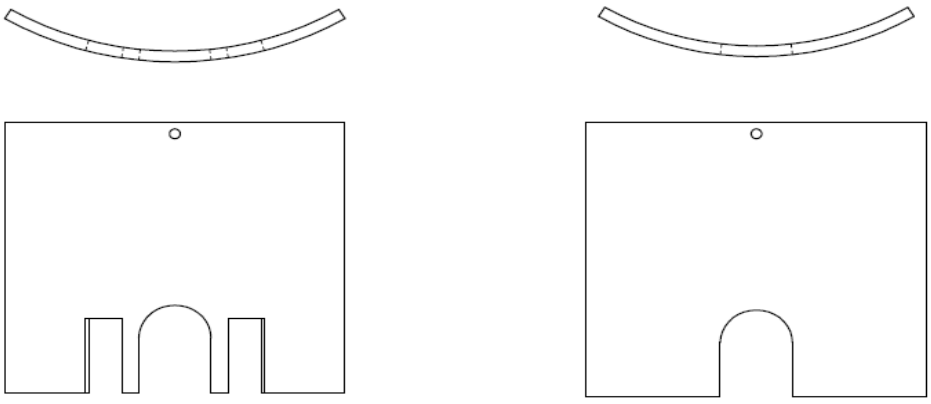
No: 1104041222/226

APPENDIX 4

ITEM	DESCRIPTION	NUMERO\NUMBER	MAT'L







INTERNAL REINFORCEMENT PLATE

EXTERNAL REINFORCEMENT PLATE

Transformer Mounting Bracket Failures
Analysis Report

Transformer Mounting Bracket Failures Analysis Report

Newfoundland Power
55 Kenmount Road
St-John's Newfoundland

Date: April 24th 2008

Written by:
Alain Tremblay
Professional Technologist

TABLE OF CONTENTS

1. Foreword

ABB has been manufacturing hundreds of thousands of distribution transformers, made of mild steel over the last fifty (50) years. Before 1990, those transformers were designed in ABB London facilities. In 1990, ABB transferred that technology in Quebec City plant. The design of the mounting brackets remained the same, as those transformer mounting brackets had to be in accordance to the Canadian CSA and CEA specifications. The specifications requirements regarding those brackets did not changed over the years.

At the beginning of 1990 and up to the end of 1998, ABB has been manufacturing transformers made of stainless steel grade 304L.Those transformers, have been delivered to *Hydro-Quebec* and were installed at that time in Madeleine Islands.

In 2001 ABB began to manufacture transformers made of stainless steel grade 316L to be used in Maritimes Provinces by *Maritime Electric* and *Newfoundland Power*. Customers purchasing specification requirements for those transformers were Canadian CEA DTWG-01 (98).

2. Problem/Issue

2.1 Mandate

As we know, each transformer manufactured as per Canadian specifications, shall be fit out with two (2) mounting brackets. The upper mounting bracket main task is to support the total vertical load of the transformer, while the lower mounting bracket shall stabilize the transformer on the pole.
Both brackets are exposed to horizontal load, such as various winds intensity.

Since 1999, our customer *Newfoundland Power* has reported to *ABB* six (6) incidents relating to the failure of transformer mounting brackets. One (1) failure occurred with a transformer made of mild steel, manufactured in *ABB London* and five (5) failures on transformers made of Stainless steel grade 316L manufactured by *ABB Quebec. Maritime Electric* and *Hydro-Quebec* never reported any incidents related to the mounting brackets.

Those incidents led *ABB* to make an investigation and a study on that issue. This report aims to provide technical information about those specific cases and will suggest some recommendations.

2.2 Process

In order to figure out the Problem/Issue we will elaborate a list of all incidents reported to *ABB* by *Newfoundland Power*, with more details. With the help of reports study, made by third parties, we will comment and explain the failure modes. Security factors calculation and loading analysis, as work hypothesis, will be discussed. Besides we will comment on factors increasing stress on the brackets and stress factors combination. Tests results will be also analysis. In addition we will evaluate the conformity of ABB mounting brackets to the Canadian specifications used by Newfoundland Power. In conclusion, recommendations will be proposed.

3. Incidents Summary

3.1 Reported in 1998

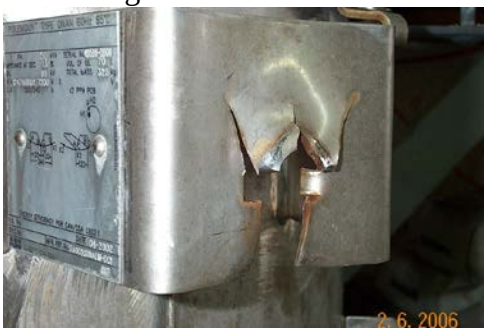
A 50 Kva transformer made of mild steel manufactured by ABB London in 1992 fell from a pole. The failure occurred at the upper mounting bracket. The mounting brackets were made of mild steel 7 GA (0.179”).
Total weight of the transformer: 280 kg

3.2 Reported in July 2003

A 50 Kva transformer made of stainless steel 316L installed in February 2003 was removed with the lower mounting bracket broken. The mounting brackets were made of 10 GA (0.140”) thickness SST 316L. During the same period a transformer manufactured from another supplier, fell from the same pole.
Total weight of the transformer: 330 kg

3.3 Reported in June 2006

A 50 Kva transformer made of stainless steel 316L manufactured in June 2002 having a failure at the upper mounting bracket was discovered in service and removed before a total failure of the brackets. The mounting brackets were made of 10 GA (0.140”) thickness SST 316L.
Total weight of the transformer: 330 kg



3.4 Reported in October 2007

A 50 kva transformer made of stainless steel 316L manufactured in May 2002 fell from a pole. The mounting brackets were made of 10 GA (0.140”) thickness SST 316L.
Total weight of the transformer: 330 kg

3.5 Reported in February 2008

A 50 Kva transformer made of stainless steel 316L that was manufactured in March 2003 was discovered with upper and lower mounting brackets distorted. The mounting brackets were made of 10 GA (0.140”) thickness SST 316L. Total weight of the transformer: 330 kg

3.6 Reported in March 2008

A 25 Kva transformer made of stainless steel 316L that was manufactured in March 2003 was discovered with upper and lower mounting brackets distorted. The mounting brackets were made of 10 GA (0.140”) thickness SST 316L. Total weight of the transformer: 200 kg

4. Failures analysis

4.1 Metallurgical Report made by *Laboratoire Ferex*

As a result of the second failure reported in July 2003 (see section 3.2), *ABB* has mandated *Laboratoire FEREX* to make a metallurgical report and an investigation analysis, on the broken bracket. Thus, the QC-03150-01 report dated January 6th, 2004 analyzed the following data:

- Part accordance with drawing specification.
- Chemical material analysis and material hardness accordance.
- Stereoscopic and microscopic observation.
- Stress analysis of the ruptured surfaces.

4.1.1 Conclusion of report

The investigation was performed in many steps, which are: material characterization, macroscopic and microscopic observations.
The material from which the bracket is made was identified as Stainless steel 316L. Analysis revealed that its chemical composition and its hardness are in accordance with general specification given in ASTM A666-94 standard.
Macroscopic observations made it possible to state that the part failed in two (2) steps under dynamic solicitation. Microscopic observations gave many indications that bolt tightening probably accelerated failure. Many cracks initiated around the bolt hole. Moreover, the bracket was scratched and deformed in that specific area. Finally, vibrations are probably responsible for fatigue propagation of the cracks.

4.1.2 Recommendations of report

A washer should be installed between the bolt and the bracket to give a more uniform tightening and to protect the bracket surface. Moreover, a maximum tightening torque should be proposed by design engineers to avoid, over stressing the part. Concerning the dynamic load applied on the bracket, it is probably caused by system vibrations and wind. The pole on which the transformer is installed could be inspected for abnormal movement.

* *ABB* made physical test and calculations regarding maximum torque. *ABB* proposed 55 foot/pound as maximum tightening torque to avoid permanent distortion of the bracket when tightening.

4.2 Metallurgical Report made by *Bodycote Testing*

As a result of the fourth failure reported in October 2007 (see section 3.4), *ABB* has mandated *Bodycote Testing Group* to make a metallurgical report and an investigation analysis, on the broken bracket. Thus, the #2846 report, dated January 4th, 2008 analyzed the following data:

- Chemical material analysis.
- Macrofractographic, microfractographic and metallographic observations.
- Stress analysis of the ruptured surfaces.

4.2.1 Conclusion of report

Failure analyses were performed on sections of the broken mounting bracket as well as on a new bracket. On the broken bracket, four (4) cracks were identified. All four (4) fracture surfaces revealed fatigue propagation. The origins of two (2) cracks are the anti-rotation lugs (see appendix 1). The fracture origins of two (2) others cracks, reveal that shear marks of the hole have possible damaging effects.

A metallographic evaluation was performed on an intact bracket. The presence of a crack is very obvious. The manufacturing of the mounting brackets by shearing is producing stress risers (cracks). Those stress risers contribute to the creation of fatigue cracks. Those fatigue cracks propagated when the mounting bracket was too strained by the transformer weight and the regional winds.

Chemical analysis complies with stainless steel AISI 316

5. Canadian Specifications Requirements for mounting brackets

5.1 Design requirements

The requirements for mounting brackets are described in Appendix 2. Appendix 3 and Appendix 4 represent the ABB brackets design. Dimensions meet all the specification requirements. The only difference is the anti-jump and anti-rotation feature. This feature represented in the specification is slightly different from the ABB design. In the specification it is located at the bottom of the slot. ABB located that feature near the top of the slot. However the specification does not requires a specific location for anti-jump and anti-rotation design.

This specification has been replaced by CSA C2.2-06 in 2006. The requirements for mounting brackets in CSA C2.2-06 are all the same as CEA DTWG-01 99.

5.2 Testing requirements

The tests requirements for mounting bracket are described below.

9.9 Mounting Bracket Tests

9.9.1 Vertical Loading

An empty transformer tank, with affixed brackets, shall be mounted on a vertically positioned rigid flat steel plate with 3/4 inch machine bolts tightened with torque as per CSA C83-96 Table 2. The location of point A1, as shown below in Fig 13(a), shall be established. The tank shall then be loaded vertically. The applied load shall be of such value that, combined with the weight of the tank and brackets, the final load shall be 1-1/2 times the weight of the complete transformer (including insulation oil). The final load shall in no instance be less than the weight of the complete transformer (including oil) plus 115 kg. The tank shall then be unloaded. Displacement of point A1, in the direction of the load, shall not exceed 2 mm.

9.9.2 Horizontal Loading

A transformer tank and bracket assembly identical to that described above shall be mounted as described above, and the location of point A2 established. The tank shall then be loaded horizontally, as shown in Fig 13(b). The load, in kN, shall be:

(a) for transformer tanks of round or elliptical cross-section, 1.1 times the projected area in square metres;
(b) for tanks of square or rectangular cross-section, 1.8 times the projected area in square meters.

The load shall then be removed. Displacement of point A2, in the direction of the load, shall not exceed 2 mm.

---

* Source CEA DTWG-01 (98) Revised 1999-07

5.3 Mounting bracket Tests results

5.3.1 Mounting bracket tests performed by *ABB*

The mounting bracket tests, requested by DTWG-01 have been performed on many tanks. At the moment of first failure in 1998 those tests have been done, on a same tank made of mild steel, with 7 GA (0.179") thickness mounting brackets.

Vertical loading

Applied Load DTWG-01	Displacement Point A1	Result
420 Kg	0.34 mm	Pass

Horizontal loading

Applied Load DTWG-01	Displacement Point A2	Result
111 Lbf	0.45 mm	Pass

In November 2007 tests have been performed on a 50 Kva tank made of stainless steel with 10 GA thickness brackets, made by Frameco. The vertical and horizontal tests have been done with the load as requested by CEA DTWG-01 specification.

Tests results with loads requested in DTWG-01:

Vertical loading

Applied Load DTWG-01	Displacement Point A1	Result
495 Kg	0.508 mm	Pass

Horizontal loading

Applied Load DTWG-01	Displacement Point A2	Result
95 Lbf	0.36 mm	Pass

Following those tests, we have performed other tests on the same tank (50 Kva), using 2.2 times the weight of the complete transformer as vertical load and 1.7 times the requested horizontal load

Vertical loading

Applied Load ABB	Displacement Point A1	Result
725 Kg	1.49 mm	Pass

Horizontal loading

Applied Load ABB	Displacement Point A2	Result
170 Lbf	1.06 mm	Pass

Those tests have been performed in ST-Joseph de Beauce at *Frameco* facilities. The tank has been installed on a steel pole with mounting bolts tightened to 55 foot/pound. Steel bullets have been used for vertical load and hydraulic cylinder for horizontal load.

5.3.2 Mounting bracket tests performed by *Bodycote Testing Group*

In January 2008, three (3) 50 Kva tanks, with 10 GA stainless steel mounting bracket, have been tested at the Pointe-Claire facilities of *Bodycote Testing Group.* Tanks have been manufactured by *Frameco.*

Tests results for vertical loading requested in DTWG-01:

Tank #	Applied Load	Displacement Point A1	Result
1	495 Kg	1.09 mm	Pass
2	495 Kg	1.13 mm	Pass
3	495 Kg	1.22 mm	Pass

Tests results for horizontal loading requested in DTWG-01:

Tank #	Applied Load	Displacement Point A2	Result
1	92 Lbf	1.56 mm	Pass
2	92 Lbf	1.65 mm	Pass
3	92 Lbf	1.93 mm	Pass

6. Loading Analysis

6.1 History of mounting brackets design.

The stainless steel 10 GA (0.140”) thickness of the mounting brackets, have been introduced in 1990. We don’t know whether, *ABB London* has been manufactured stainless steel transformers for *Hydro-Quebec* before 1990. ABB Quebec plant has been applying at that moment the 10 GA design made in *ABB London*, after having repeated the DTWG-01 type tests. The thickness for mild steel at that time was 7 GA (0.179”). The thickness of the equivalent bracket in stainless steel has been implemented to10 GA, before 1990 in London plant. In 1996 the thickness of the mild steel bracket has been increased to 3/16” (0.1875), due to material availability with the 7 GA. The stainless steel brackets thickness has been increased to 3/16” (0.1875”) in January 2007, based on *Newfoundland Power* request.

6.2 Cracks propagation and stress concentration.

According to the results of another study, made by *Service D’Ingénierie Jean Massé*, the stress concentration area is located near and around the anti rotation lugs (see appendix 1). As mentioned in that study, it has been revealed by *Bodycote,* that microscopic cracks have been observed even on a new bracket in the anti-rotation lugs area, most probably because of the shearing manufacturing process. By shearing the material, extra stress is given to modify the geometry, but residual stress remains at the extremity which may cause microscopic cracks. Those cracks are subject to propagation since they are located directly in the area of stress concentration. The growth is usually accomplished in three phases; *crack initiation, crack propagation, crack unstable*.
The cracks propagation will depend on stress, induced by various factors, such as wind loading, torque value, shape of pole, pole stability, pole diameter, installation process, ice loading etc. The results of that study explain that a combination of those factors in conjunction, may lead to the propagation of the cracks. However the impact of one of those factors alone is not significant on cracks propagation.

It must be mentioned that a balancing movement of the pole increases stress in the plate around the slot. An angle modification of a few degrees of the pole, combined with the movement of the pole by winds, change the reactions and create an unpredictable loading cycle.

6.3 Security factors calculation

Newfoundland Power raises questions about mounting brackets thickness. At their request *ABB* made an evaluation. *ABB* and a third party, *Service D’Ingénierie Jean Massé*, made a report of expert to verify, whether the thickness of the material is appropriate. Calculation has been made based on customer specification requirements DTWG-01 as following

- Vertical loading at 1.5 times the weight of the transformer (clause 9.9.1)
- Horizontal loading has been determined in Lbf (pound-force), at 1.1 times the projected area in square meters (clause 9.9.2). This value represents approximately 130 Km/h wind velocity.

Results of that study have demonstrated adequate security factors, regarding design and material thickness.

7. Conclusion

When we look at the pictures of the failures in section 3, we can identify three (3) different types of failure:

- Upper mounting bracket failure
- Lower mounting bracket failure
- Both mounting brackets distortion.

The case of the lower mounting bracket transformer failure raises questions: why the lower bracket failed, whereas the vertical load is supported by the upper bracket? Moreover that transformer was the second one falling from the same pole, in the same period. It is quite surprising. The other case suggests that a very heavy horizontal force pushed on the transformer, until the distortion of the brackets. Other surprising fact: the difference in weight and tank dimensions is significant between 25 Kva and 50 Kva. However both use the same brackets. According to the structural calculation analysis, the bracket should not fail. No clues or evidence have been found when analyzing the failures. In fact, several aggravating factors remain unknown.

The studies made on brackets have revealed that shearing material may initiate cracks. However the brackets have always been manufactured this way. The history of the brackets demonstrates the reliability of ABB design. This factor alone shall not be considered as a reason for failures.

The security factors calculation have showing suitable results. The bracket design has passed the DTWG-01 standard tests and the tests performed by *ABB* with heavier loads in 2007. The mounting bracket tests have been performed many times over the years. In 1993 the tests have been performed on a 19 inches as well as a 20 inches tank diameter. In 1996, those tests were done once again on every ABB tank diameter, including stainless steel tanks. All those tests results were successfully. Those tests results demonstrate beyond doubt, the conformity of ABB design to the Canadian specifications.

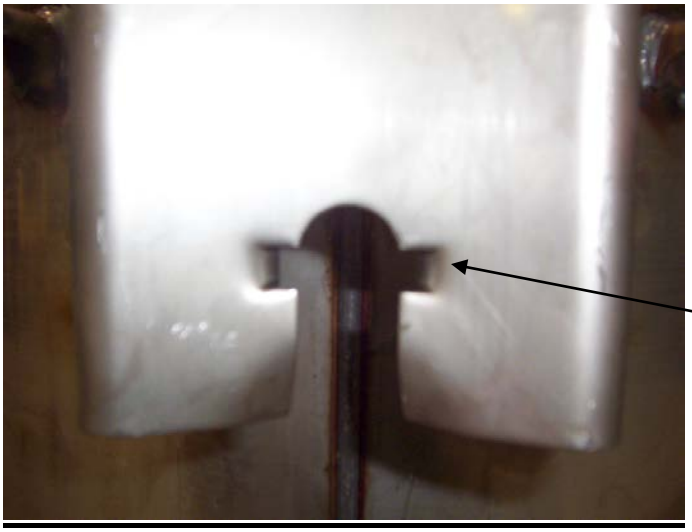
In addition, ABB is manufacturing from the beginning of 2007, laser cutting mounting brackets made of 3/16" (0.1875") thickness.

8. Recommendations

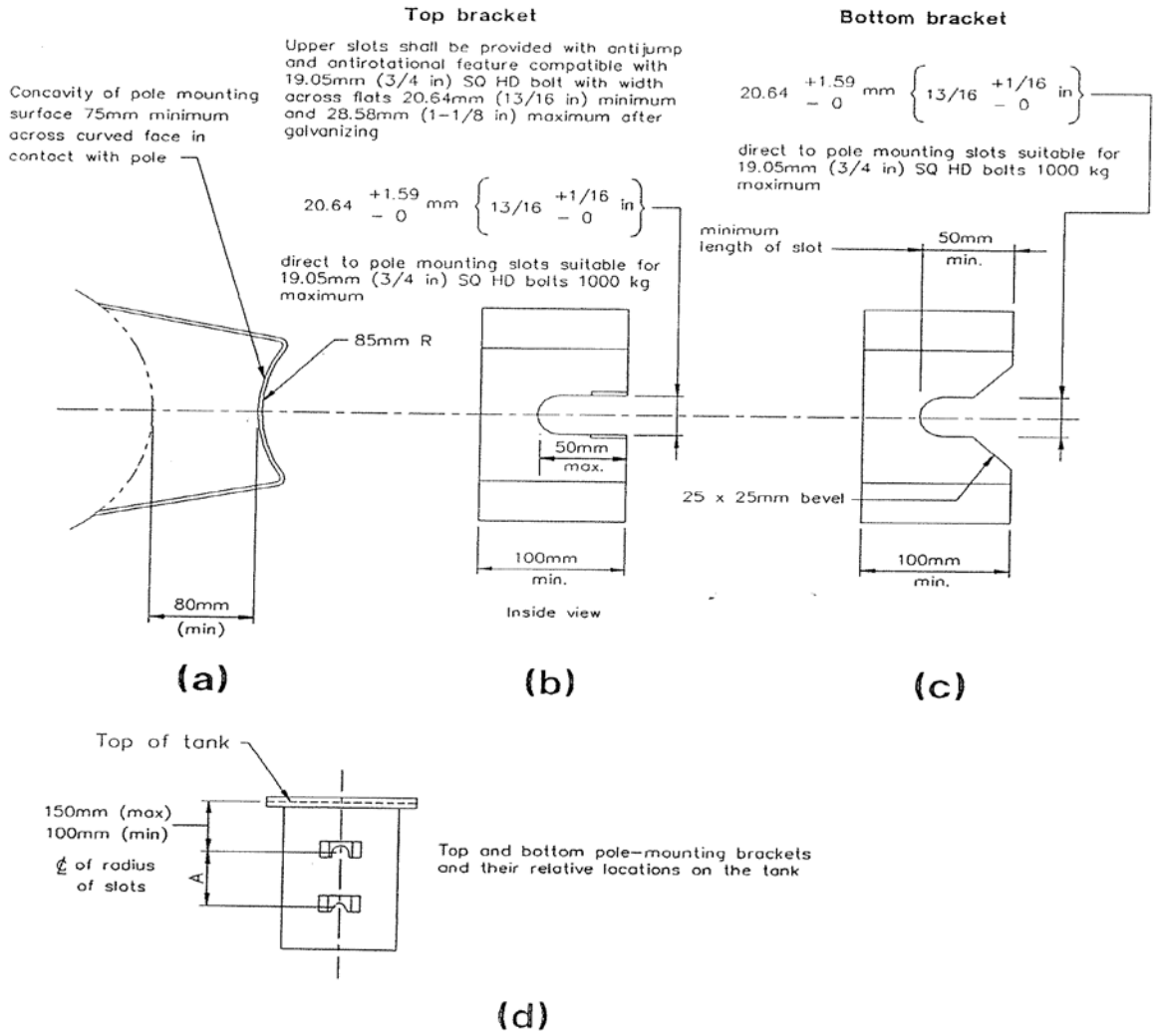
As mentioned previously in this report, one factor can be identified as the main work hypothesis responsible for the failures: wind. According to the study of experts, area of Newfoundland can be considered as the most windy place in Canada in terms of intensity and force of winds. This is a major factor involved in failures. Other factors such as the ones listed before, have also contributed to that situation. ABB made a study with known factors, but Newfoundland Power should verify many parameters unknown from ABB to get a better understanding of the problem. As agreed between *ABB* and *Newfoundland Power*, a survey will be done on installation condition in the field. It is also clear that *ABB* brackets are in conformity with the Canadian specifications. From this perspective, Newfoundland Power should take into consideration this particular need in their purchasing specifications.

To conclude, we noticed that the loading tests do not reflect the reality in the field. The loads on the brackets in the field are combined loads, while the Canadian specifications required the loads on the brackets to be tested separately. There are questions about those requirements: Do those requirements are severe enough? Do those requirements match the needs of Newfoundland Power?

APPENDIX 1



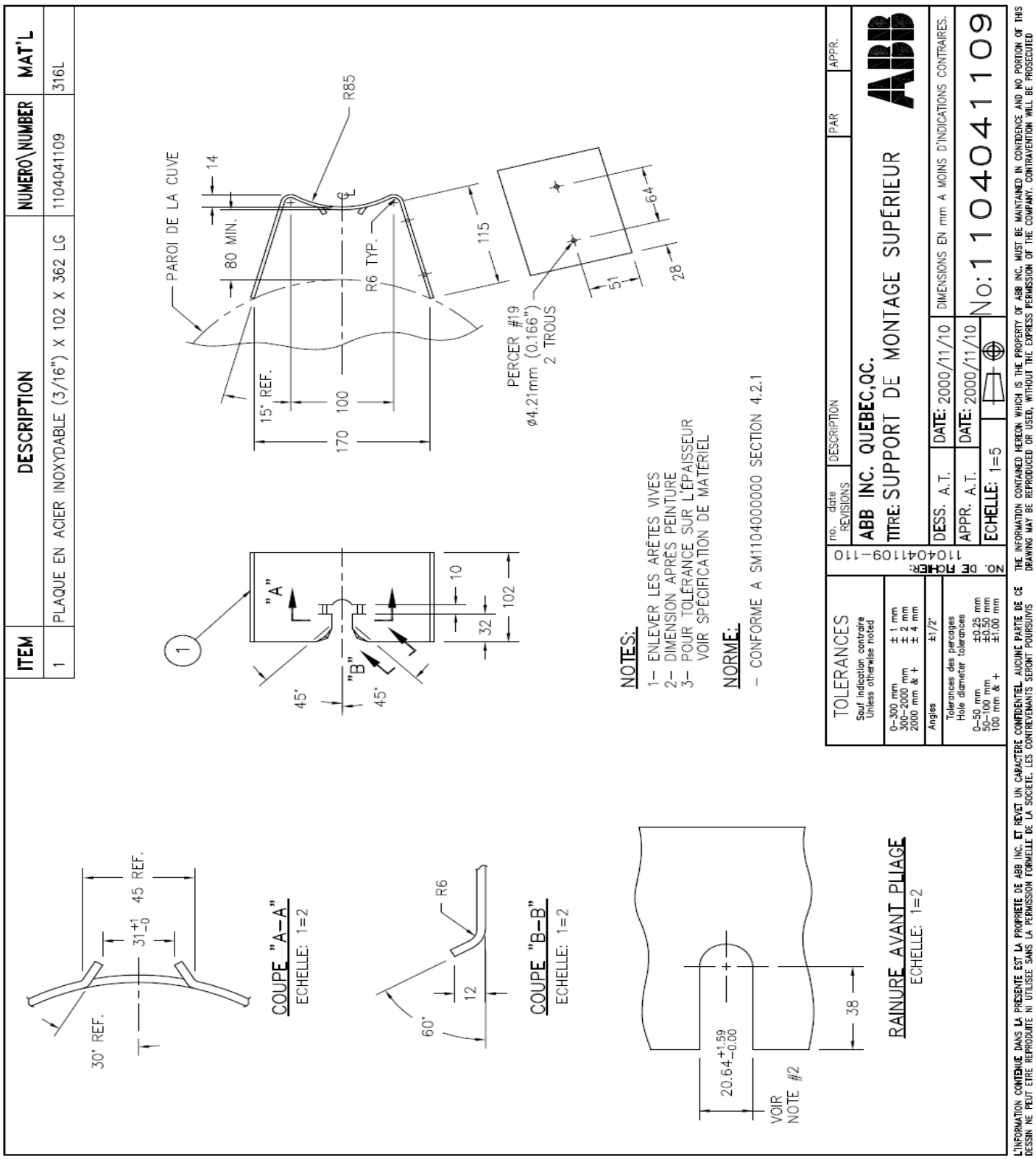
APPENDIX 2



Single Phase Ratings, kV•A	A^{+0}_{-5} (mm)
10 - 25	370
50 - 100	550
167	730

FIG 9 - DIRECT - TO - POLE MOUNTING BRACKETS
(See Clause 8.5)

APPENDIX 3


ITEM
DESCRIPTION
NUMERO\NUMBER
MAT'L
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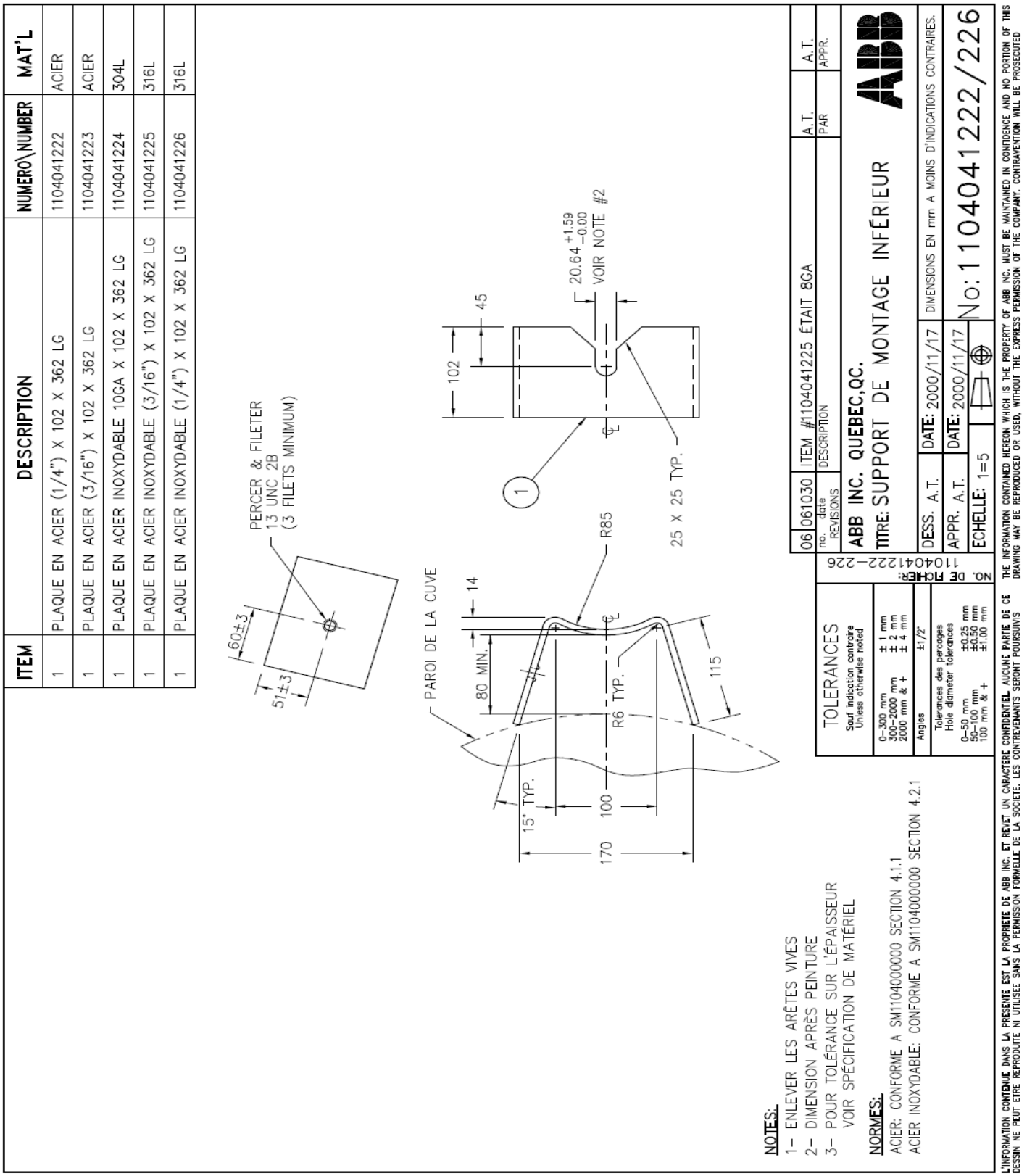
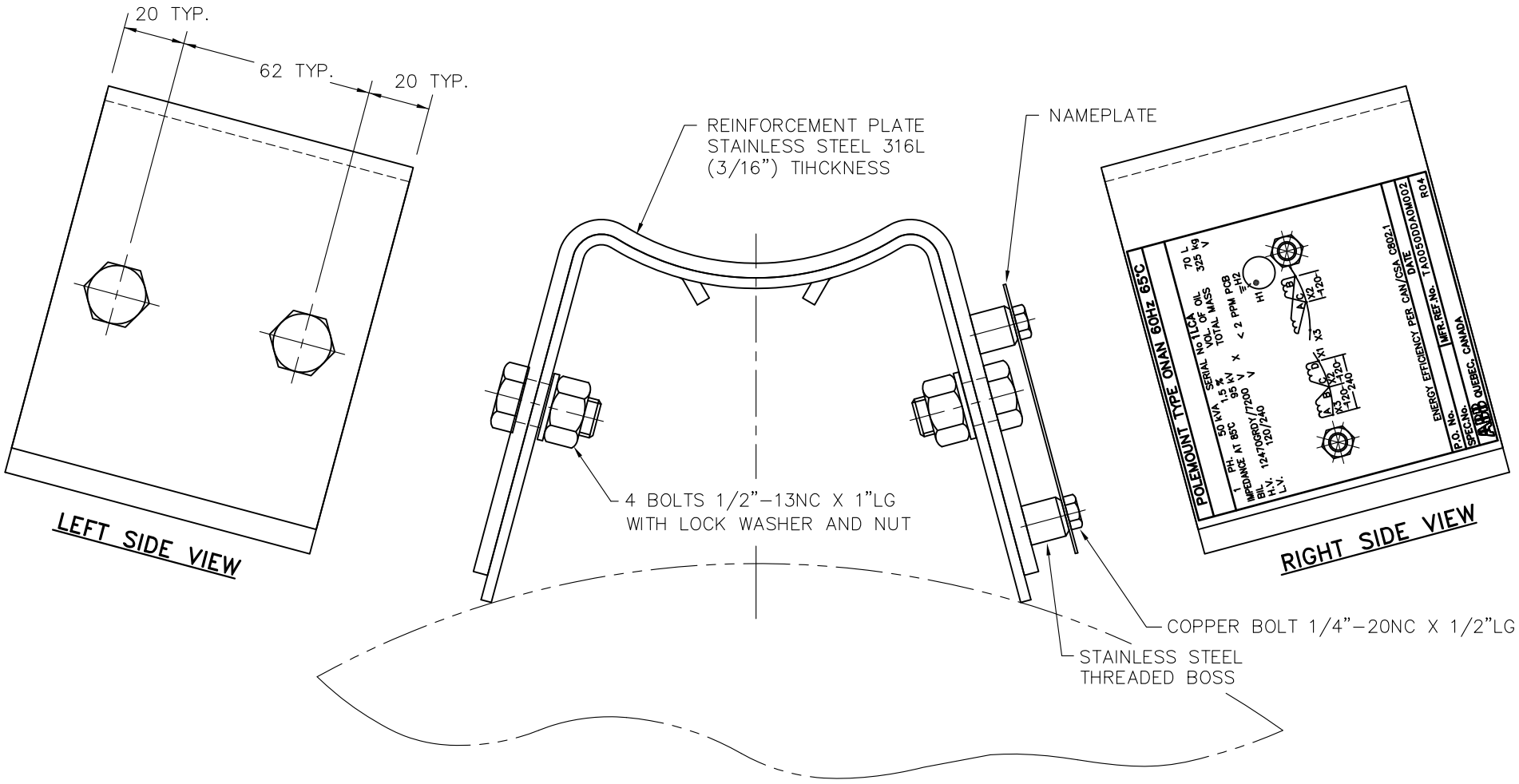
PLAQUE EN ACIER INOXYDABLE (3/16") X 102 X 362 LG
1104041109
316L
PAROI DE LA CUVE
80 MIN.
14
15° REF.
170
100
R6 TYP.
R85
115
PERCER #19
ø4.21mm (0.166")
2 TROUS
64
51
28
"A"
"B"
45°
45°
10
32
102
NOTES:
1- ENLEVER LES ARÊTES VIVES
2- DIMENSION APRÈS PEINTURE
3- POUR TOLÉRANCE SUR L'ÉPAISSEUR VOIR SPÉCIFICATION DE MATÉRIEL
NORME:
- CONFORME A SM1104000000 SECTION 4.2.1
30° REF.
31 +1 -0
45 REF.
COUPE "A-A"
ECHELLE: 1=2
60°
12
R6
COUPE "B-B"
ECHELLE: 1=2
20.64 +1.59 -0.00
VOIR NOTE #2
38
RAINURE AVANT PLIAGE
ECHELLE: 1=2
TOLERANCES
Sauf indication contraire
Unless otherwise noted
0-300 mm ± 1 mm
300-2000 mm ± 2 mm
2000 mm & + ± 4 mm
Angles ±1/2°
Tolerances des perçages
Hole diameter tolerances
0-50 mm ±0.25 mm
50-100 mm ±0.50 mm
100 mm & + ±1.00 mm
NO. DE FEUILLE
1104041109-110
no. date REVISIONS
DESCRIPTION
PAR
APPR.
ABB INC. QUEBEC,QC.
TITRE: SUPPORT DE MONTAGE SUPÉRIEUR
DESS. A.T.
DATE: 2000/11/10
APPR. A.T.
DATE: 2000/11/10
DIMENSIONS EN mm A MOINS D'INDICATIONS CONTRAIRES.
ECHELLE: 1=5
No: 1104041109
L'INFORMATION CONTENUE DANS LA PRESENTE EST LA PROPRIETE DE ABB INC. ET REVET UN CARACTERE CONFIDENTIEL. AUCUNE PARTIE DE CE DESSIN NE PEUT ETRE REPRODUITE NI UTILISEE SANS LA PERMISSION FORMELLE DE LA SOCIETE. LES CONTREVENANTS SERONT POURSUIVIS
THE INFORMATION CONTAINED HEREON WHICH IS THE PROPERTY OF ABB INC. MUST BE MAINTAINED IN CONFIDENCE AND NO PORTION OF THIS DRAWING MAY BE REPRODUCED OR USED, WITHOUT THE EXPRESS PERMISSION OF THE COMPANY. CONTRAVENTION WILL BE PROSECUTED

APPENDIX 4

ITEM	DESCRIPTION	NUMERO\NUMBER	MAT'L
1	PLAQUE EN ACIER (1/4") X 102 X 362 LG	1104041222	ACIER
1	PLAQUE EN ACIER (3/16") X 102 X 362 LG	1104041223	ACIER
1	PLAQUE EN ACIER INOXYDABLE 10GA X 102 X 362 LG	1104041224	304L
1	PLAQUE EN ACIER INOXYDABLE (3/16") X 102 X 362 LG	1104041225	316L
1	PLAQUE EN ACIER INOXYDABLE (1/4") X 102 X 362 LG	1104041226	316L



Miscellaneous Drawings and Sketches



TOP BRACKET ASSEMBLY
PLAN VIEW

INSTALLATION PROCESS

1–REMOVE NAMEPLATE
2–PUT THE REINFORCEMENT PLATE IN PLACE ON THE UPPER TRANSFORMER BRACKET
3–DRILL OR PUNCH 4 HOLES (ø9/16") THROUGH THE UPPER TRANSFORMER BRACKET
4–INSTALL BOLTS AND NUTS AS SHOWN
5–DRILL 2 HOLES (ø5/16") ON NAMEPLATE THROUGH THE EXISTING HOLES
6–PUT BACK NAMEPLATE WITH 2 BOLTS AS SHOWN

FILE No: TOP BRACKET REINFORCEMENT	no. date REVISIONS	DESCRIPTION	BY	APPR.
	ABB INC. QUEBEC,QC. TITLE: TOP BRACKET REINFORCEMENT PLATE			
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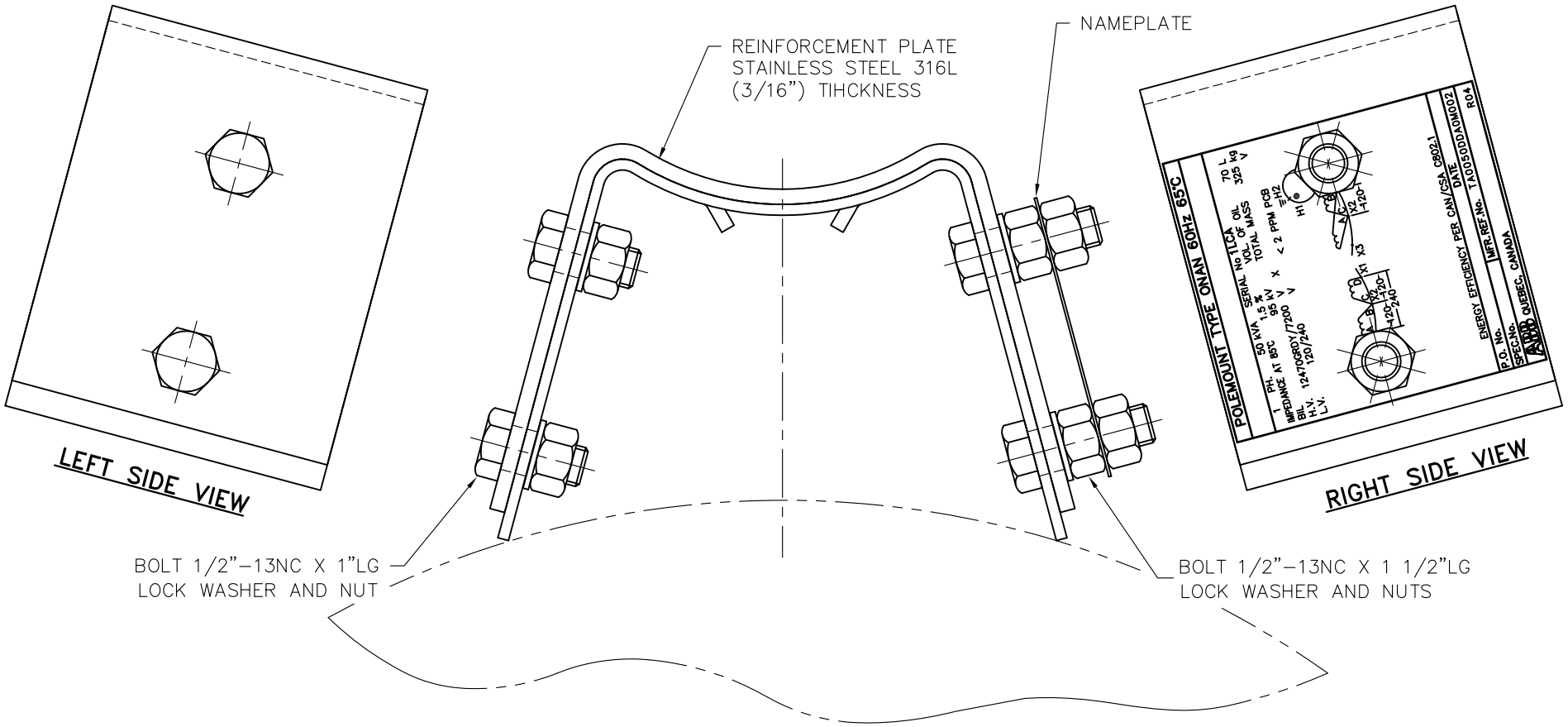
	APPR. A.T.	DATE: 2009/01/20	No:	
	SCALE: 1=2			



TOP BRACKET ASSEMBLY
PLAN VIEW

INSTALLATION PROCESS

1–REMOVE NAMEPLATE
2–PUT THE REINFORCEMENT PLATE IN PLACE ON THE UPPER TRANSFORMER BRACKET
3–DRILL 4 HOLES (ø9/16") THROUGH THE UPPER TRANSFORMER BRACKET
4–INSTALL BOLTS AND NUTS AS SHOWN
5–DRILL 2 HOLES (ø9/16") IN NAMEPLATE THROUGH THE EXISTING HOLES
6–PUT BACK NAMEPLATE WITH 2 EXTRA NUTS AS SHOWN

FILE No: TOP BRACKET REINFORCEMENT

no. date REVISIONS	DESCRIPTION	BY	APPR.

ABB INC. QUEBEC,QC.

TITLE: TOP BRACKET REINFORCEMENT PLATE

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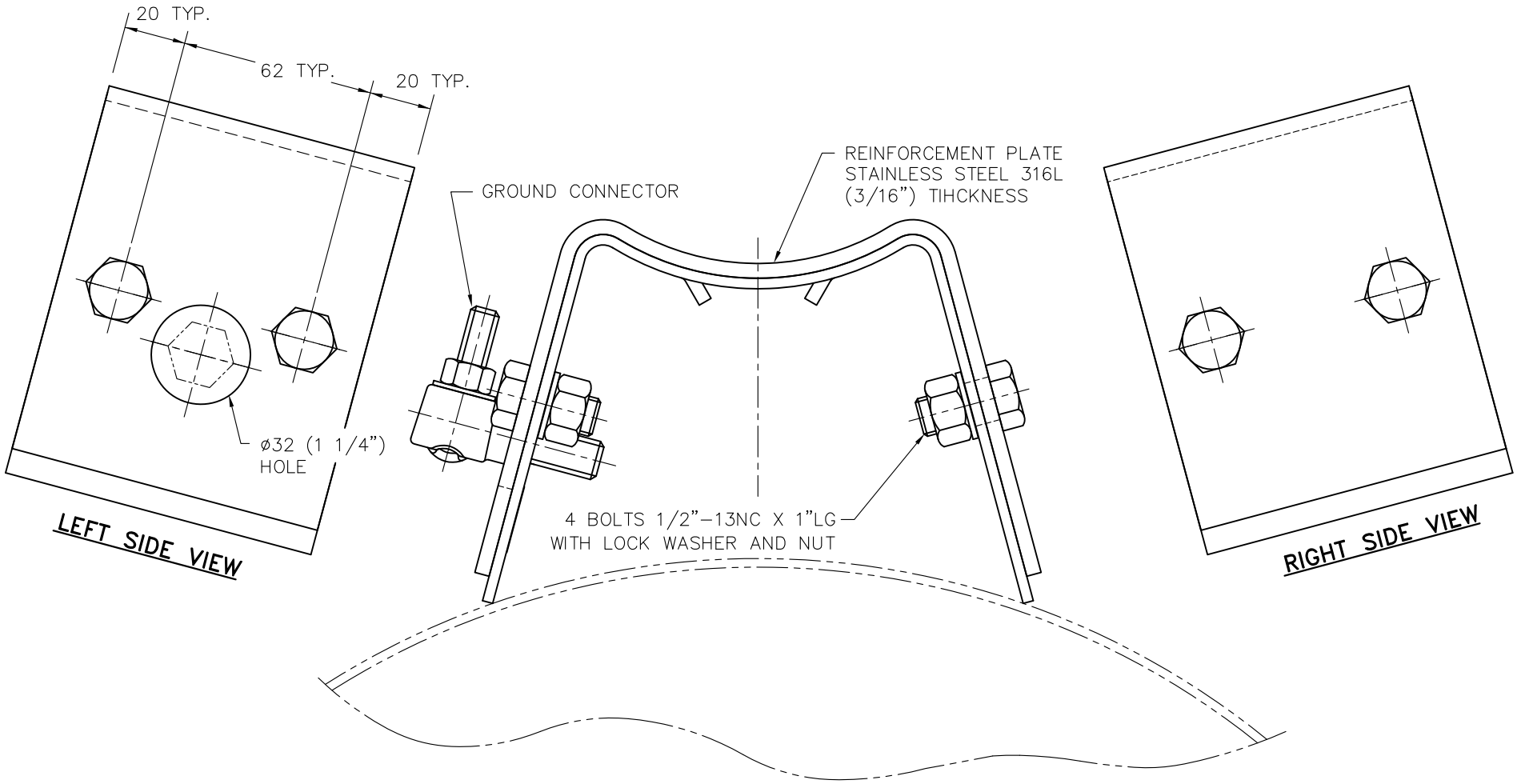

BOTTOM BRACKET ASSEMBLY
PLAN VIEW

INSTALLATION PROCESS

1–REMOVE GROUND CONNECTOR
2–PUT THE REINFORCEMENT PLATE IN PLACE ON THE LOWER TRANSFORMER MOUNTING BRACKET
3–DRILL OR PUNCH 4 HOLES (ø9/16") THROUGH THE LOWER TRANSFORMER BRACKET
4–INSTALL BOLTS AND NUTS AS SHOWN
5–PUT BACK GROUND CONNECTOR TO ITS ORIGINAL LOCATION

FILE No: BOTTOM BRACKET REINFORCEMENT

no. date REVISIONS	DESCRIPTION	BY	APPR.

ABB INC. QUEBEC,QC.

TITLE: BOTTOM BRACKET REINFORCEMENT PLATE

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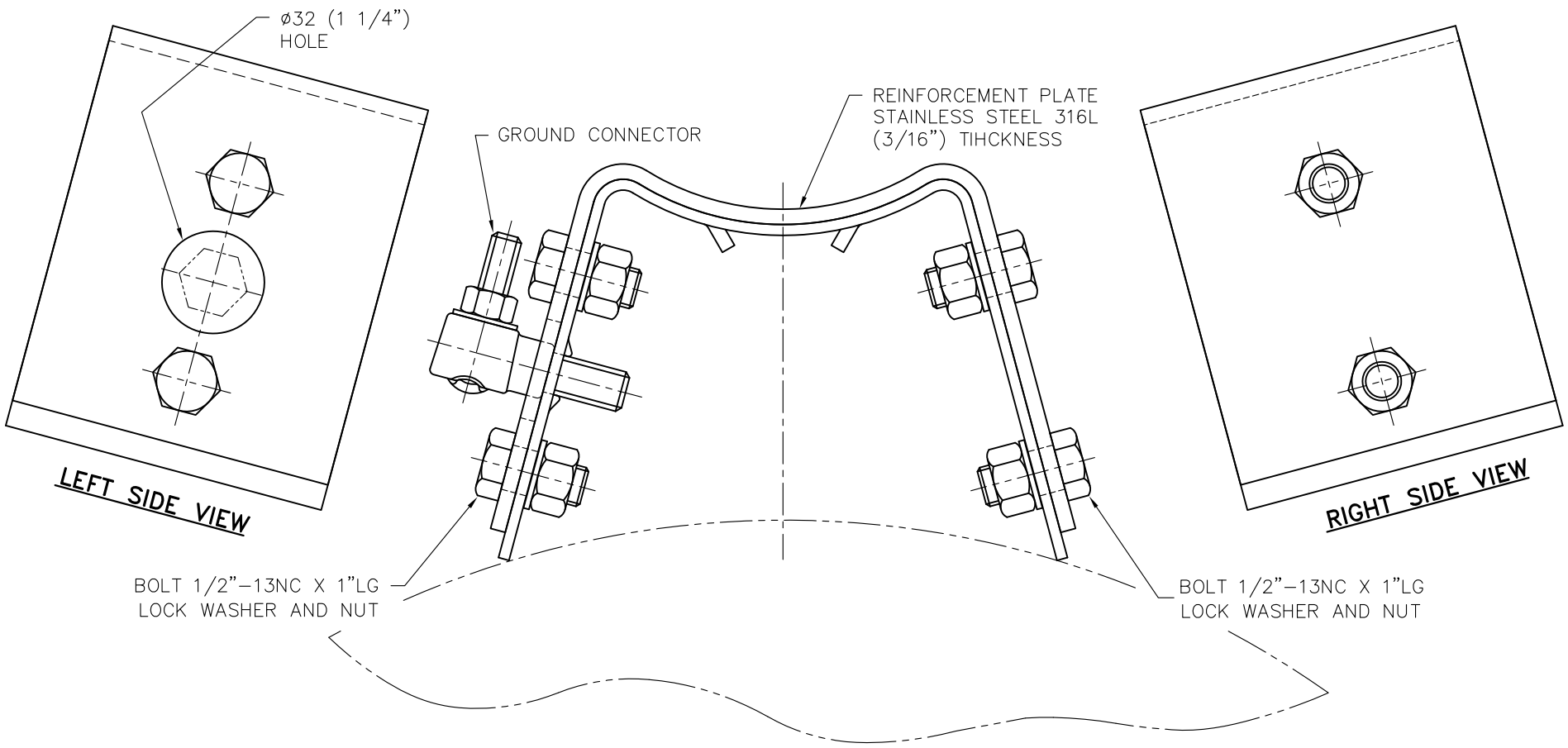

BOTTOM BRACKET ASSEMBLY
PLAN VIEW

INSTALLATION PROCESS

1–REMOVE GROUND CONNECTOR
2–PUT THE REINFORCEMENT PLATE IN PLACE ON THE LOWER TRANSFORMER MOUNTING BRACKET
3–DRILL 4 HOLES (ø9/16") THROUGH THE LOWER TRANSFORMER BRACKET
4–INSTALL BOLTS AND NUTS AS SHOWN
5–PUT BACK GROUND CONNECTOR TO ITS ORIGINAL LOCATION

FILE No: BOTTOM BRACKET REINFORCEMENT

no. date REVISIONS	DESCRIPTION	BY	APPR.

ABB INC. QUEBEC,QC.

TITLE: BOTTOM BRACKET REINFORCEMENT PLATE

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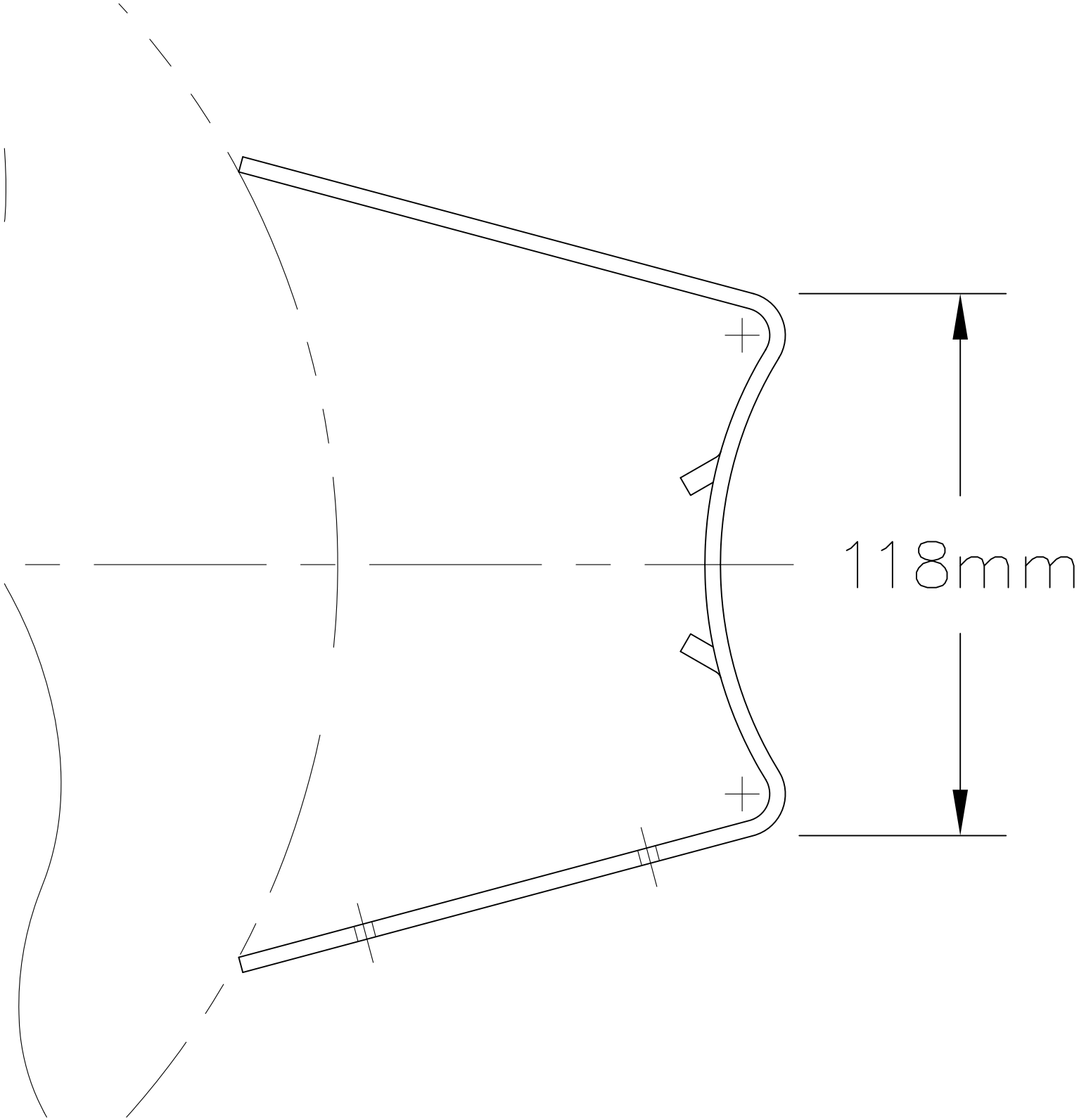
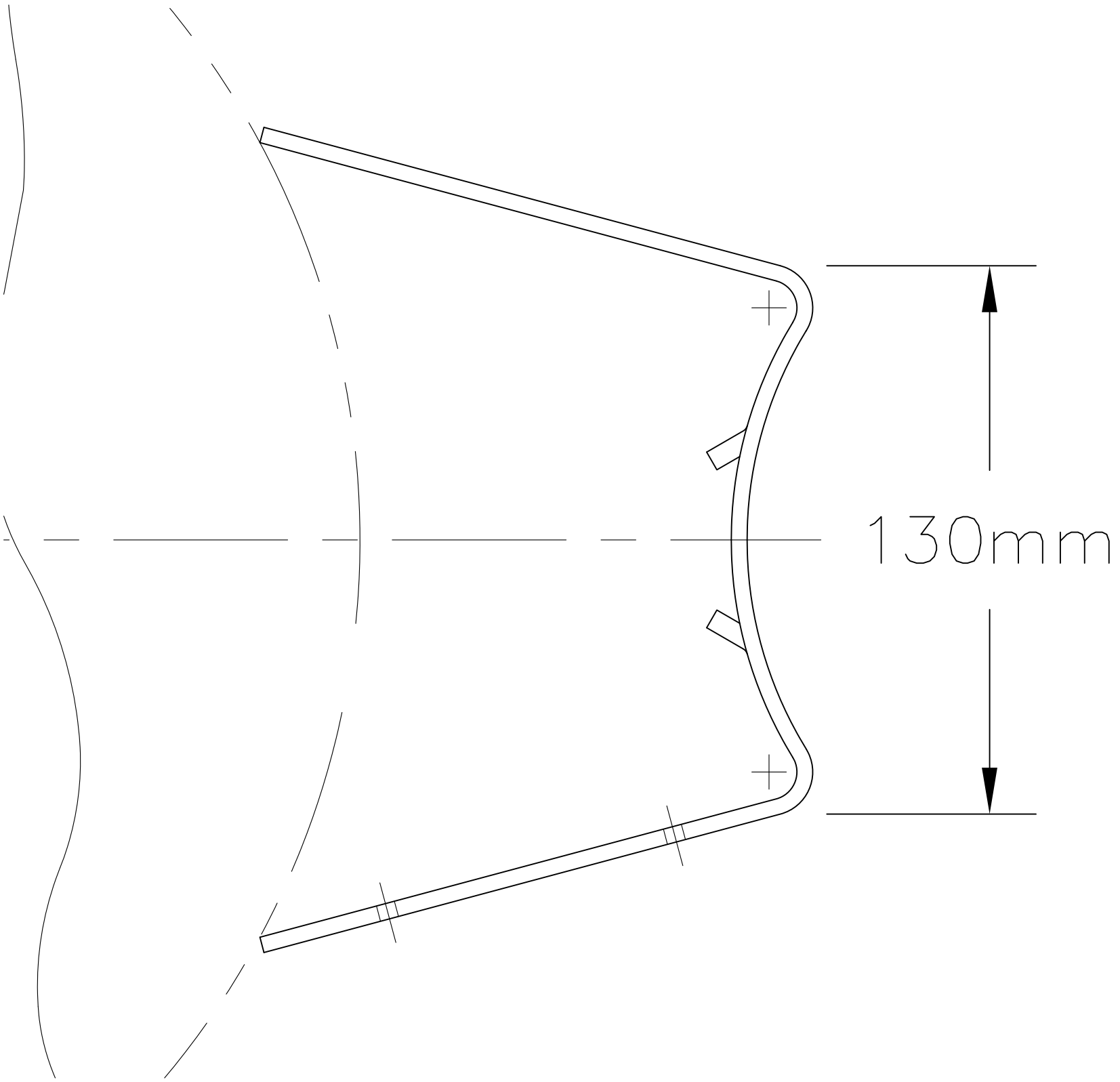
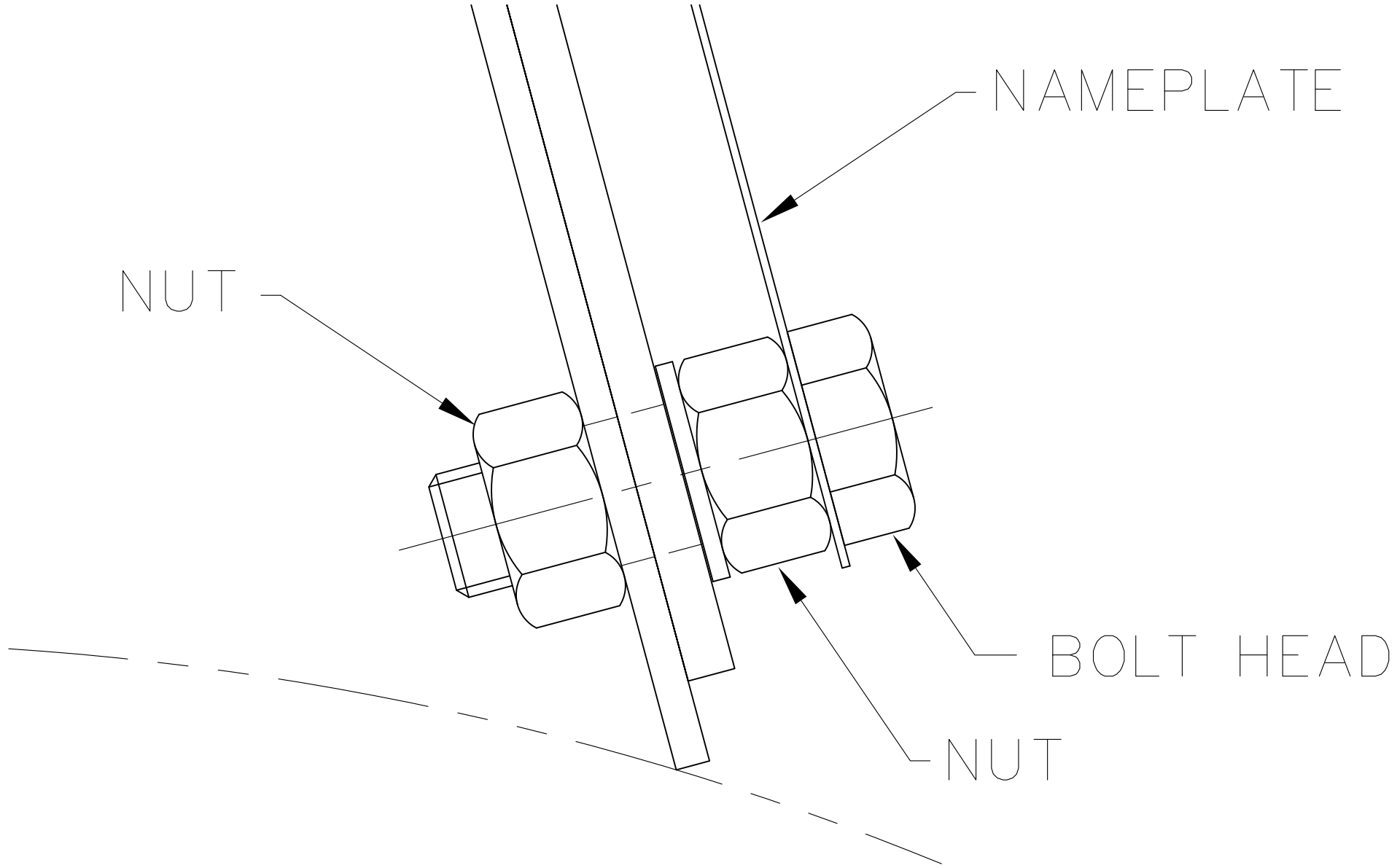
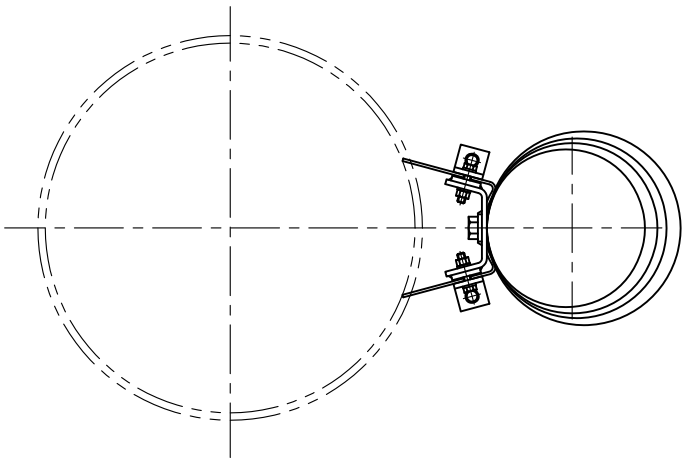
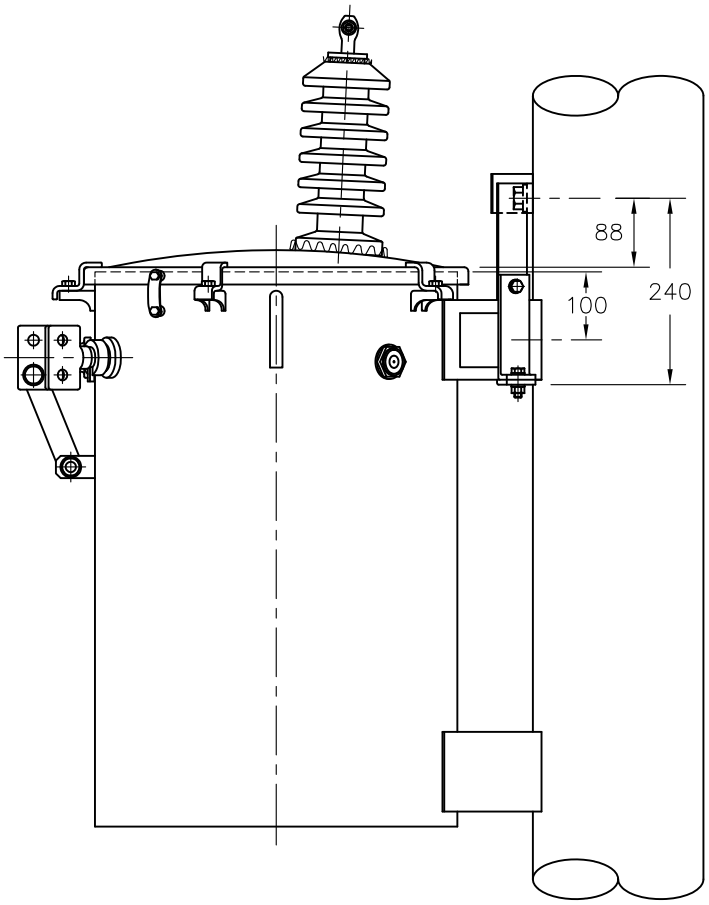
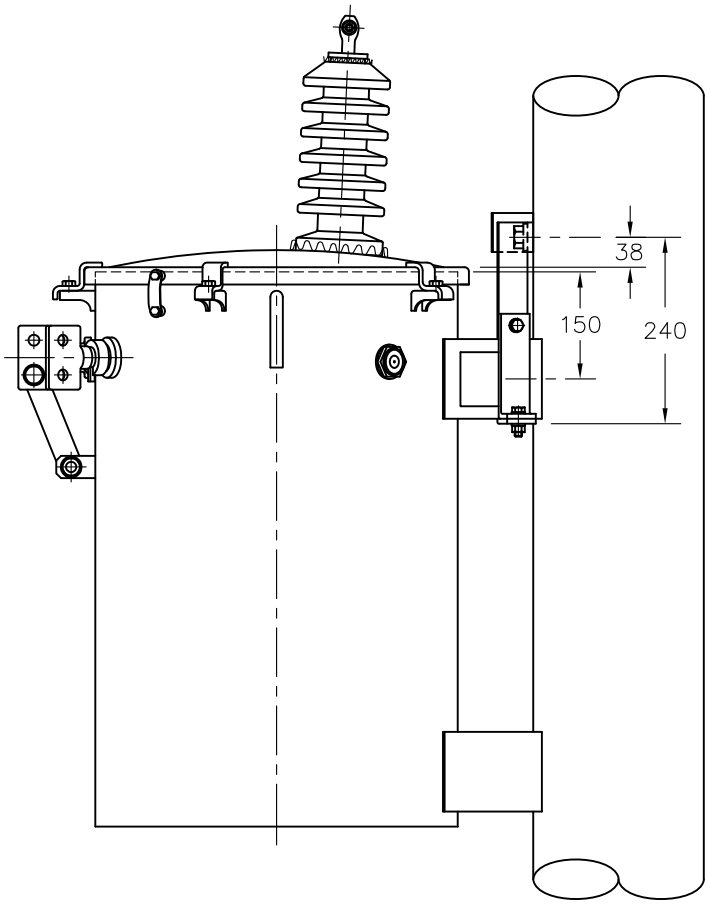

118mm


130mm


NAMEPLATE
NUT
BOLT HEAD
NUT







no. date REVISIONS	DESCRIPTION	BY	APPR.

ABB INC. QUEBEC,QC.

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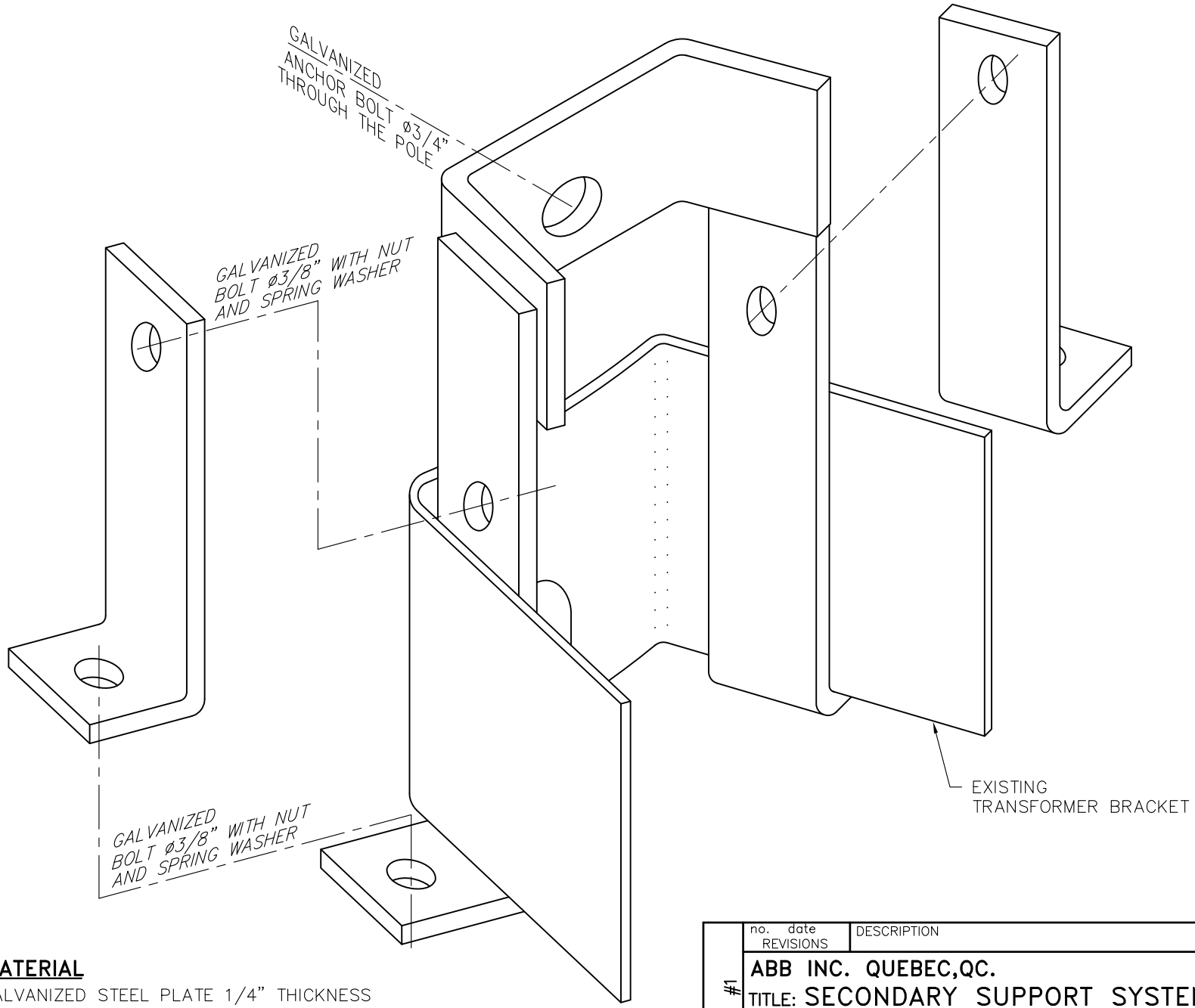
FILE No:



MATERIAL

GALVANIZED STEEL PLATE 1/4" THICKNESS

NOTE:

NEED TO HAVE 2 DIFFERENT DESIGNS: ONE DESIGN FOR TANKS
MADE BY "FRAMECO" AND ONE DESIGN FOR TANKS MADE BY "JL GROUP"

no. date REVISIONS	DESCRIPTION	BY	APPR.

ABB INC. QUEBEC,QC.

TITLE: SECONDARY SUPPORT SYSTEM
OPTION #1

FILE No: OPTION #1

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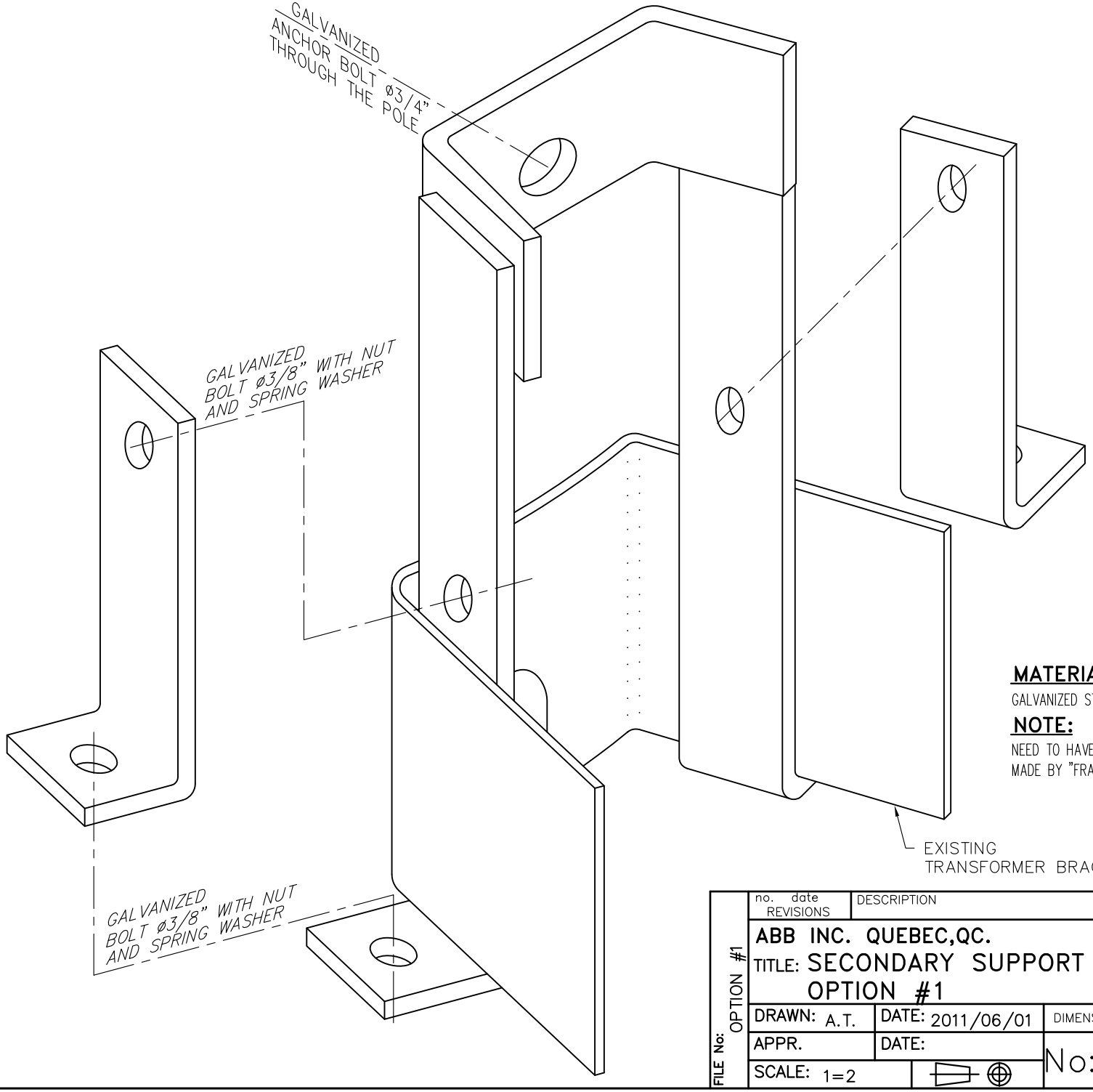


MATERIAL

GALVANIZED STEEL PLATE 1/4" THICKNESS

NOTE:

NEED TO HAVE 2 DIFFERENT DESIGNS: ONE DESIGN FOR TANKS
MADE BY "FRAMECO" AND ONE DESIGN FOR TANKS MADE BY "JL GROUP"

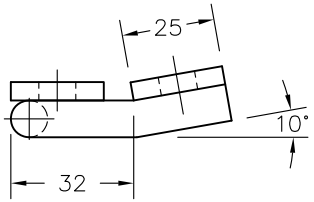
no. date REVISIONS	DESCRIPTION	BY	APPR.

ABB INC. QUEBEC,QC.

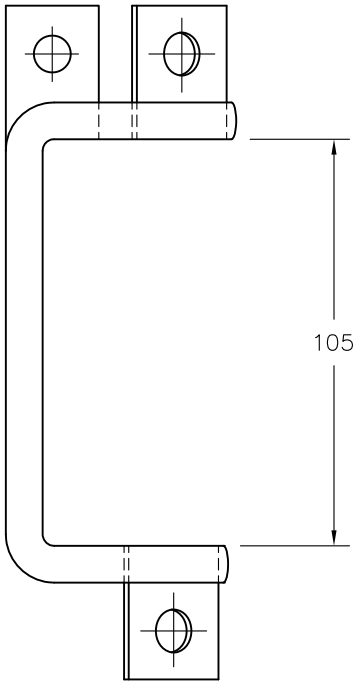
TITLE: SECONDARY SUPPORT SYSTEM
OPTION #1

DRAWN: A.T.	DATE: 2011/06/01	DIMENSIONS IN mm UNLESS OTHERWISE SPECIFIED.
APPR.	DATE:	
SCALE: 1=2		No:

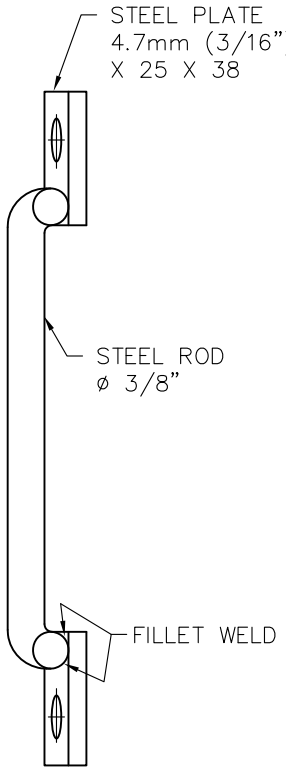
FILE No: OPTION #1



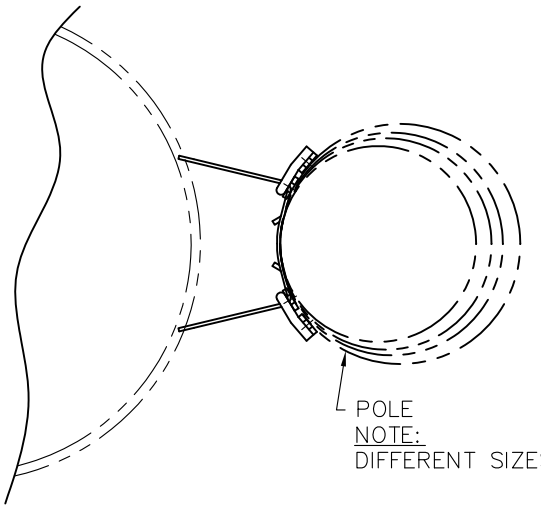
PLAN

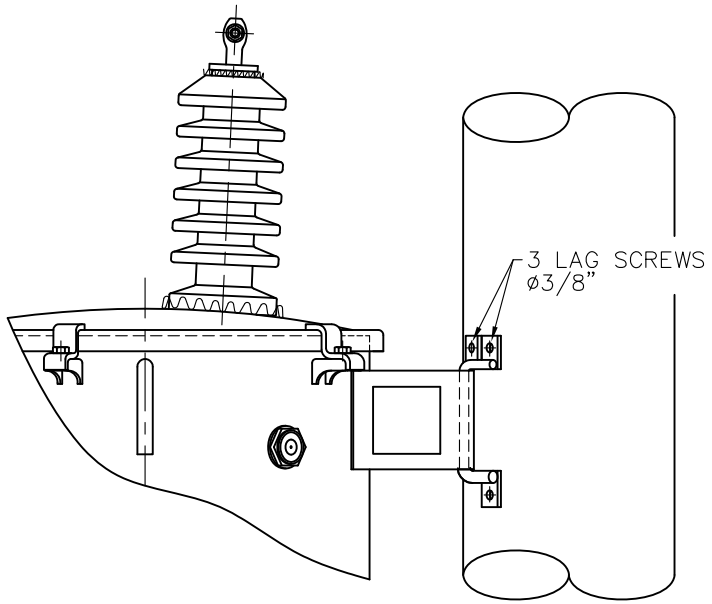


ELEVATION



PROFILE





MATERIAL: GALVANIZED STEEL

NOTE:

CAN BE USED ON "FRAMECO" AND "JL GROUP" BRACKETS

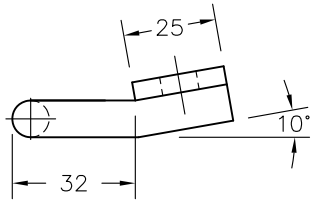
FILE No: OPTION #2-3 LAG SCREW

no. date REVISIONS	DESCRIPTION	BY	APPR.

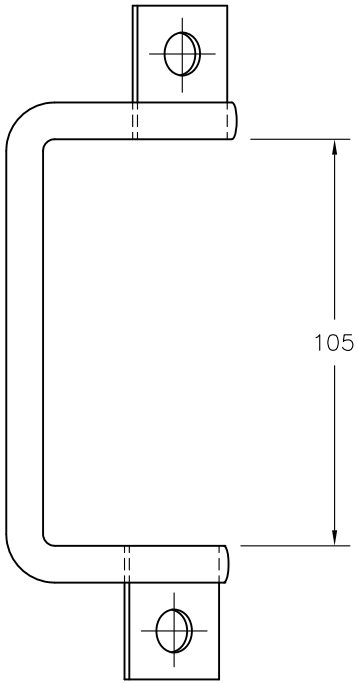
ABB INC. QUEBEC,QC.

TITLE: SECONDARY SUPPORT SYSTEM
OPTION #2 WITH 3 LAG SCREWS

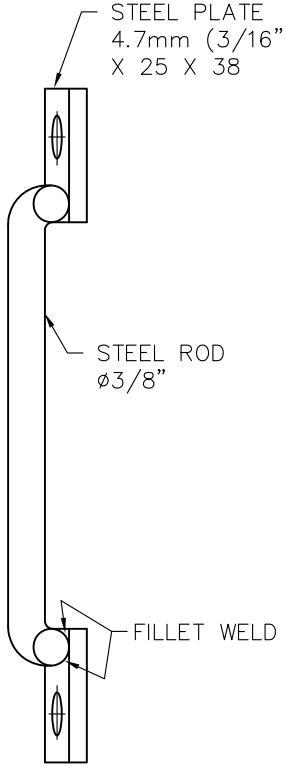
DRAWN: A.T.	DATE: 2011/06/01	DIMENSIONS IN mm UNLESS OTHERWISE SPECIFIED.
APPR.	DATE:	
SCALE: 1=2		No:



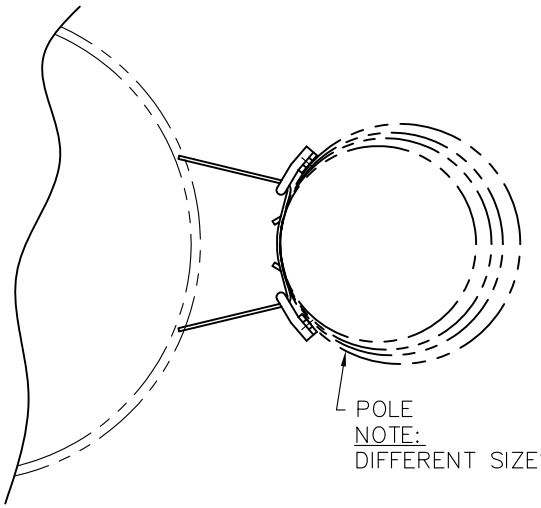
PLAN

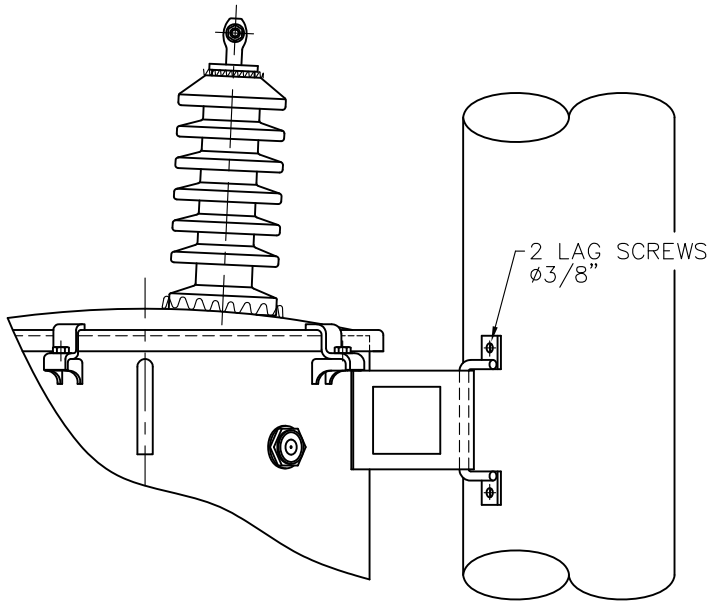


ELEVATION



PROFILE





MATERIAL: GALVANIZED STEEL

NOTE:

CAN BE USED ON "FRAMECO" AND "JL GROUP" BRACKETS

no. date REVISIONS	DESCRIPTION	BY	APPR.

ABB INC. QUEBEC,QC.

TITLE: SECONDARY SUPPORT SYSTEM OPTION #2

DRAWN: A.T.	DATE: 2011/06/01	DIMENSIONS IN mm UNLESS OTHERWISE SPECIFIED.
APPR.	DATE:	No:
SCALE: 1=2		

FILE No: OPTION #2