From: Evan Vokes
Sent: Thursday, August 04, 2011 5:08 PM
To: Tanya Rolston
Subject: RE: Counter-bore and taper versus back-bevel

Hi Tanya
Just following up
Did the admission that the two keystone hydrotest failures occur come through while I was on vacation?
Its is a pretty open secret with the additional impact that hydrotest failures look bad to the regulator

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From: Evan Vokes
Sent: Monday, June 20, 2011 1:28 PM
To: Tanya Rolston
Subject: FW: Counter-bore and taper versus back-bevel

From: Evan Vokes
Sent: Monday, April 26, 2010 4:34 PM
To: Claude Albert
Cc: Ron Curle; Veronique Cantin; Rick Ostrom; Salvatore Delisi
Subject: RE: Counter-bore and taper versus back-bevel

I have seen Kenneth's presentation before and that whole business is avoidable but one of the big problems is TCPL never made counter bore mandatory because there is a real upfront cost.
His recommended practice for 3-D bends is on the right path but not entirely there. As you would have seen in my presentation, we do not cellulosic weld X 80 with E9010 because your preheat requirement would have to be too high. Bainitic microstructures don't like this. Keep in mind that we use the same specifications for our AIV lines and do not have problems we see down south.
I should have included counter-bores in my presentation to Bison months ago .

The primary importance of the TES MECH TRANS is at the welding side of the contracts but it has a very large implication for probability of detection for NDE.
I consider back beveled transitions with what I call the three strike rule:
a) Average welder has trouble welding the root and cannot field back-weld (welding ease)
b) NDE is compromised as we can not get good radiography and we can not use AUT (NDE compromised)
c) Bending moment applies maximum stress to the weld (mechanical stress)

The welders don't admit it but they like us when we do counter-bore as equal wall thicknesses, the pipes are much easier to weld; this is because the heat sink is different for both sides. I used to have a hard time understanding why the LOF and cracking were predominant on the thin wall side but the welder must concentrate the heat of the root pass on the thick side or there will be a massive root defect. As a consequence we often have IP and other planar defects on the thin wall side. Since we have likely used a cellulosic rod, we now have the conditions to promote cracking; Susceptible material, Stress, and Hydrogen. The reason why it works so well in the shop is that our components can often be back-welded. If you were to have a hydro-test failure in the shop it is not on PHMSA's radar as much as a ROW failure.
Welding contractors should love it as if you make the counter-bore 5 inches deep, the internal clamp can work and you have a regular SMAW poor boy or GMAW mainline weld as compared to a slow SMAW tie-in with external clamps ($$$$) . Louisbourg and Ledcor both do this as it is so fast to do in the field but we can not apply an ECA to the weld unless we specifically quality one for this.

Before we delve into NDE, we need to look at fracture mechanics. Kt is an indication of geometry on strength to propagate an indication. (YS/kt) Volumetric indications have a kt =3, planar indications kt =6 and cracks kt =27. Planar indications and cracks have a massive effect on strength and radiography is good at finding volumetric indications not planar indications or cracking.

When we use counter-bores I can have a good film with radiography or I can have excellent AUT. One of the big problems we run into with NDE is that if we **do not** counter-bore we must use Double Wall Single Image (DWSI) radiography, as the weld must be performed with an external clamp with all the attendant engineering concerns that are associated with this condition. The physical requirement for a tie-in weld dictates the DWSI RT and this will give poorer resolution with X ray and worse with gamma. This is related to the fact that radiography is knocking out different wavelength of photons and X-ray has a wider band than gamma. You just have to look at the light spectrum to see the problem. Just because we can see the wires does not mean we have found all the out of plane LOF and cracking. When I have materials over 16mm I really need some concentrated energy to penetrate the material so I have to move to gamma. The different elements for gamma sources; Cs, Co Se etc all have different ranges which is why the gamma sources give different resolutions. Co is the worst for resolution as it gives a very narrow spectrum but with a extremely strong penetration. The problem with X ray is powerful units are very large where as gamma sources are very small and so strong X-ray sources are hard to make field portable. The next problem is the film. High energy gamma sources suffer from two sources of un-sharpness. The geometric un-sharpness is related to diffraction off sharp features which muddles the film. Film un-sharpness is high energy from gamma radiation inadvertently exposes film next to the areas of proper exposure so now I have two concerns for un-sharpness of the film on a technique that is sensitive to volumetric indications. If I counter-bore, I can use AUT and see everything the first time with no messing about regardless of thickness.

Counter-boring also moves the bending moment from welds that contain defects into the parent metal. IF you look at a weld on flange they have very strict requirements for angle to move the bending moment past the weld so very similar, by counter-boring, we are moving the bending moment. This was proven many years ago and we still get leaks at road-bores with back beveled transitions. If you have access to the S drive there are a couple of delayed failure reports one from Red Deer and another one from Crossfield (right on highway 2) and I am waiting to see the Manitoba failure from last summer. What I often do when I draw the problem out on the whiteboard or paper is to show a roof structure of a large steel framed industrial building such as Costco or any number of others. When we look at the roof we see that the bolted connections are made several feet to the side of the columns. This is to make sure that the bolts are a) in the neutral axis of the bending moment, b) bolts are half as strong in shear as they are in tension so we do not want to apply a shear stress. (I will send a picture later). Becky, we could probably get you to draw this out with a moment diagram to show people. In our case we use counter bore shape to shed the load to apply the bending moment outside the welded area.

There are two problems with this
1) The contractors love to flay the skin from our projects for requesting something so silly when in truth each transition is to their benefit. The counter-bores can be supplied to a project as heavy wall counter-bore transition pups for a small job where they do not want to mobilize a field counter-bore Cat.(in Kenneth's presentation)
2) Often time's contractors do a horrible job of machining the transitions and the resulting surface causes diffuse reflection rather than the desired specular reflection which is a pain for AUT.

As you probably realize History has shown us that many construction hydro test failures are at back-beveled transitions shot with gamma and Keystone proved it. The laws of gravity have not changed in recent history either. You might get a way with back bevels and using gamma for inspection but you must accept that a hydrotest failure is now an inherent risk.

We have paid for AUT, lets exploit it, buck up for the counterbores and have worry free project.

Hope this helps
Evan

From: Claude Albert
Sent: Monday, April 26, 2010 2:56 PM
To: Evan Vokes
Cc: Ron Curle; Veronique Cantin
Subject: FW: Counter-bore and taper versus back-bevel
Importance: High

Evans

I forgot to copy you on these e-mails, what is your take on this?

Cheers,

Claude Albert
Construction Quality Manager
Bison Pipeline Project
Tel: 713 354 6292
Cell: 832 588 0112

From: Ron Curle
Sent: Thursday, April 22, 2010 6:06 PM
To: Claude Albert; Veronique Cantin; Gerard Lalonde; Gary Babich; Joanne Unger
Subject: FW: Counter-bore and taper versus back-bevel
Importance: High

Veronique

What field welds (of different WTs) do we currently allow back-bevel?

Then let's make an estimate of qty, so that we can evaluate Claude's proposal

$first – decision second – it might be "Chicken S"

Please reply-all

Thanks!

Ron

From: Claude Albert
Sent: Thursday, April 22, 2010 4:34 PM
To: Ron Curle
Cc: Veronique Cantin; Shane Megoran; Gary Babich; Joanne Unger
Subject: FW:
Importance: High

Ron

The attached is the third bulletin received from PHMSA concerning welds of different wall thickness. As you know, today we had the visit from PHMSA at PG yard, to review out Welding Procedure Qualification process, of which they were very happy with, I will submit the meeting note tomorrow.

During the meeting with PHMSA, they express their concern on welds between pipes of different wall thickness, using a back bevel of transition.

I recommend we ONLY weld pipe of different wall thickness, all welds not only golden welds, using counter bore to ensure the welds will always be done on same wall thickness. It could be a counter bore done in the field using acceptable field equipment or a counter bore pup, which could be done in a shop.

This would eliminate PHMSA's concern on the subject, and would allow the project to adequately use AUT for the welds,

Cheers,

Claude Albert
Construction Quality Manager
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From: kenneth.lee@dot.gov [mailto:kenneth.lee@dot.gov]
Sent: Monday, April 19, 2010 10:00 AM
To: Claude Albert; Shane Megoran
Cc: stephen.bender@dot.gov; chris.hoidal@dot.gov
Subject:

Attached is a presentation I gave last month on PHMSA girth weld construction concerns your review. I welcome any comments or questions you may have. I'll see you Thursday in Houston.

Thanks,
Ken

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