Mandeep Singh <msingh@coade.com>
01/16/2002 07:00 AM

To: ibrahim.demir@power.alstom.com
cc: cortex@cortex.com.au, robert.weidemier@power.alstom.com
Subject: RE: [cortex] CODECALC-Horizontal Vessel Program {01}

Security Level:? Internal

Dear Mr. Demir,

Thanks for your suggestions.

We will provide an input, for the factor used in calculating the Q2 force. I am trying to get some documents on this and can fax it to you.

CodeCalc considers the longitudinal force (wind/Seismic) is divided among the 2 saddles, as in Dennis Moss's book. We are thinking of providing an input for the longitudinal load. So, that way you can enter your own longitudinal load on saddle to model the pier deflection or make 1 saddle to handle all of the longitudinal load. We will also add an input for the friction coeff to model the friction force.

We are also thinking of adding the check of the baseplate for the bending stress due to the maximum pressure.

For calculating the rib thickness, we assume uniform load over the ribs (just like in Dennis Moss's book). This simplified method has been known to work. This would also depend on the factor used for computing the Q2 load. So, you would have more flexibility over it after we add this input.

There does not seem to be much demand from the users to implement the "rigid" saddle design. We will keep an eye on it for future.

I can send you the paper by Ong Lin Seng on the "Effectiveness of Wear Plate at the saddle Support".

Please provide your mailing address and fax number.

Regards,
Mandeep Singh

-----Original Message-----
From: ibrahim.demir@power.alstom.com
[mailto:ibrahim.demir@power.alstom.com]
Sent: Thursday, January 10, 2002 7:14 PM
To: Mandeep Singh
Cc: cortex@cortex.com.au; robert.weidemier@power.alstom.com
Subject: RE: [cortex] CODECALC-Horizontal Vessel Program {01}
Importance: High

Dear Mandeep Singh,

Regarding the Cs parameter : The chart that you sent me is taken from

Dennis R. Moss's design handbook Procedure 3-2. However this procedure does
reflect rules of neither UBC1997 nor ASCE 7-95. The code procedures may be
seen in "SECTION 1632- Lateral Force on elements of structures,
non-structural components and equipment supported by structures" in acc.
with UBC and "9.3.3.12.1 ASME Boilers and pressure vessels" and
"9.3.3.12.2 Other Boilers and Pressure vessels" in ASCE 7-95 as you know.
These procedures have different approach and formula for pressure vessels,
therefore we would better enter our own Cs parameter into CODECALC for the
design.

Finding and deciding what to do on Q2 force is a bit complex problem.
Therefore you/we had better to introduce the eccentricity calculation and
maximum and minimum pressures and the extend of the pressure block under
the base plate. The formula that you found is a start point and very
important. Comparing eccentricity by "the length of effective base plate /
6 " and calculating the extend of pressure block under the base plate will
ease the decision making process a lot. This will tell you if the vessel is
still in balance or falling over under the transverse loads. Then, user can
decide to use or not to use holding down bolts against overturning.
Additionally, even if we use holding down bolts, we can see their
effectiveness against overturning by this method.

I apologise my misleading information on the factor of 6 in my first mail.
The Author has already considered the transverse earthquake load component
on two saddles as Ft / 2 and you show Ft as one saddle transverse loads on
one of your program output (this made me confused before). They are the
same thing for the calculation Therefore, I believe that using the factor
of 6 is the right way to go. However, If available, I would like to see the
derivation provided by the user from Dupont.

Additionally, by calculating the maximum pressure under the base plate we
will end up with the correctly selected base plate thickness. In your
calculation you distribute the total reaction force on the entire base
plate area to calculate the pressure under the base plate, you do not
consider the pressure distribution close to maximum pressure at the end
under the end rib. This is underestimating the base plate thickness.
Secondly, you dramatically underestimate the end rib axial force for
checking in the CODECALC because of the same reason. Of course everything
depends on the value of transverse force comparing with dead load reaction

force on each saddle. If transverse force gets bigger the approach that I
explained will become very important.

Is the CODECALC program considers half the longitudinal force (wind or earthquake) on each saddle? Another words, do two saddles share the longitudinal force in the program as given in the "Pressure Vessel Design
Manual by Dennis R. Moss " Procedure 3-10 Page 118. Unfortunately, I can
not see any output from calculation on the bending of ribs. Is that hidden
in your calculation? If hidden, can you give us any indication what you do? This is important to us. Because we may have to design saddles that one
saddle is to take the whole longitudinal force created by earthquake or wind. We need to allow vessel to grow in one or two direction under the thermal loading.
If there is an option in CODECALC to select/consider one or two saddles contribution to take longitudinal force, everybody will be satisfied, I imagine.

I have searched some of the sources on the design of vessels on two saddles. They consider two saddle design:
a) "RIGID", where the radial and tangential displacements are zero and the
peak stresses are obtained by the extrapolation so that peak value of stress at the horn.
b) "FLEXIBLE"
This categorisation can be seen in the following papers:
1. "An analysis For Cylindrical Vessels Under Local Loading- Application to
saddle supported vessel problems" by G.Duthie, G. C. White, A. S. Tooth, Journal of Strain Analysis Vol 17 No 3, 1982.
2. "Stresses in Horizontal Storage Vessels- A Comparison of Theory and Experiment" by A. S. Tooth, G. Duthie, G. C. White, J Carmichael, Journal
of Strain Analysis Vol 17 No 3, 1982.
I attached an image from the second reference to show you the difference.

(See attached file: Saddle categories.tif)

The book called "Theory and Design of Pressure Vessels", by John F. Harvey,
pages 459-467 gives a calculation method for the total stress calculation
in the cylindrical vessels at horn (please give me your comment on this calculation method and the approach). Harvey derives this calculation for
rigid vessels only. Even though your design calculation is for a semi-rigid
saddle, this formula should be implemented for the vessels with rigid and
semi-rigid saddles(slightly conservative). When you implement this you will see that you get higher circumferantial total stresses in the cylindrical shell by comparing with Zick analysis. If you are aware, BS 5500 gives the similar calculation for vessels only with flexible

saddles.
These are the basic differences between Zick or Harvey approach and BS5500
approach. So, users should be very careful what they are implementing by the program.

Thus, you need to be very specific to user in explaining which approach you
use in CODECALC and give direction for the differences. as you know all the
users are not knowledgeable or expert on this and they need guidance.

One more point: I did not see any guidance on the calculation of local stresses occurs on the shell for the longitudinal force application by either earthquake or friction due to thermal expansion or pier forces as described in Dennis R . Moss's book. I can not find inner ribs very effective to transfer this force or resultant moment onto the vessel. Shell
is more rigid on the side to transfer bending moment as torsion. Inside ribs have definitely a contribution, however this contribution is subject
to argument. Therefore, I personally prefer to concentrate the bending moment resultant by this longitudinal (mostly earthquake) force on the side ribs even if one saddle is reacting due to restrictions due to thermal
affects on the vessel. I will be glad if I hear something on this issue.

I am very interested in getting the paper you have mentioned on the User's
Guide on wear plate effectiveness called " Effectiveness of Wear Plate at
the Saddle Support, Ong Lin Seng, Transactions of the ASME, Journal of Pressure Vessel Technology, Vol 114, Febr 1992". I was wondering if you can
mail me this paper.

Thanks and best regards.

Ibrahim Demir
Design Engineer

To: ibrahim.demir@power.alstom.com, cortex List Member <ichamberlain@company.mail>
cc: robert.weidemier@power.alstom.com
Subject: RE: [cortex] CODECALC-Horizontal Vessel Program {01}

Security Level:? Internal

Dear Mr. Demir,

Thank you for your comments, please see my reply below:

Regarding the Cs: ==> The chart attached with this email, provides the values for the Cs parameter for various zones within USA. But, you can input your own CS value. This can entered in the seismic load dialog. When the program sees a non-zero value in the Cs input field, it uses it.

For the Q2 force, the program uses the 1.5 factor. It is based on a derivation provided by a user from Dupont. They provided convincing arguments so we modified the program. Unfortunately, we could find the sheet with that derivation. The new edition of the book 'Pressure Vessel Design Manual' by Dennis Moss, uses the factor of 3 for computing the transverse reaction Q2. The assumption used in Mr. Moss's book is that the saddle is just in the uplift condition. This also agrees with your observation.

After consulting the book "Design of welded structures" by Blodgett, I think we can compute the eccentricity = Moment / axial load,

ecc = (Ft * B / 2) / (Wo / 2) (for 1 saddle)

So, Q2 becomes:

Q2 = Wo/2 + ecc * Ft * B / E

What do you think about this. We can also provide an input field for the user defined ecc parameter.

For the analysis of horizontal vessels, the program implements the Zick analysis, so the restrictions of the method also become the restrictions of the program. We require the saddle to have at least 1 rib. If you know of any established method for the design of saddles without ribs, let us know. We can investigate it.

In the 4th point, the distance of the saddle should be positive and < 1/2 the tangent-tangent length. This is an input check and not a restriction. This input is distance from saddle to the nearest tangent. So, if the input is consistent, the maximum it can be is = 1/2 the tangent-tangent length of the vessel.

If the Saddle-tangent distance is less than the 1/2 the vessel radius, then that affects the calculation procedure. But, again it is not a restriction.

Let me know if you agree with the above.

Regards,
Mandeep Singh
Engineer/Software Developer
COADE, Inc.
www.coade.com
Ph: 281-890-4566
fax: 281-890-3301

-----Original Message-----
From: ibrahim.demir@power.alstom.com

[mailto:ibrahim.demir@power.alstom.com]
Sent: Tuesday, January 08, 2002 11:47 PM
To: cortex List Member
Cc: robert.weidemier@power.alstom.com
Subject: [cortex] CODECALC-Horizontal Vessel Program {01}
Importance: High

Attention to IAN CHAMBERLAIN,

Dear Sir,

As I mentioned on the phone, my questions are concentrated on the "Horizontal Vessel Program".

First, the calculation of the horizontal seismic load coefficient (user entered seismic zone factor CS in the user guide page 9-8) in acc. with ASCE 7-95 does not give us expected result with the seismic zone identifier
4 (I have not tried the other identifiers) for vessel calculation. For your information I found that the calculated result was underestimated. It
is an option to enter the required seismic zone factor CS, however we would
like to know that what sort of logic is available for the calculation without entering the factor CS. If you can provide the name of code section(s) or equation number(s) in addition to other selected or embedded
factors to find CS, that would be sufficient for us to make decision which
way to go.

Second question is on the "Vessel Description"on the User's Guide page 9-1.
I have the described "Pressure Vessel Design Manual" on this section. You
selected 1.5 as default value against 6 in Q2 calculation. I am basically
after a user input value instead of 1.5 or 6. Is that possible? It seems to
me that both of these values are not reliable. D.Moss has considered in his book that the bearing load or pressure distribution is triangular and
zero at the tension end maximum at compression end by assuming the effective eccentricity of the reaction point is "Base Plate Length / 6 ".
The extend of pressure block is the full length of base plate. Therefore,
the calculated moment component of reaction is equal to "Moment / (Base
plate Length / 6). However, the Author took the entire reaction force on
one saddle. This force should be devided by number of saddles. Therefore for this kind of pressure distribution, this factor should be read 3, not
6.
In the default case, CODECALC assumes that ends of the saddles are

completely under the compressive pressure. However, I still did not get the
basic approach behind this factor of 1.5. It is going to put us in the difficult situation if we use this factor without understanding it. Please
give us a brief description or a reference book to consult.
Additionally, by depending on the horizontal force or overturning moment on
the vessel we may have effective eccentricity higher than "Base plate Length / 6 " and vessel might be still balanced. We generally do not introduce holding down bolts to hold the base plate or vessel down if the
vessel still in the balanced condition under the loading. Our vessels are
always under the thermal movements in the boiler applications. Under this
condition pressure distribution on the vessel base plate will be a lot higher than CODECALC estimates with factor 1.5 or 3. Thus, I needed flexibility in the entering this factor.

Third, I need a confirmation about the restrictions of using this program.
My understanding is that this program is restricted by the type of saddles
given in the User's Guide Pages 9-12 and 9-13. Saddle shall have ribs at each end. Therefore this program can not be used for analysis or design if
the ribs are not at each end of saddle (some articles call it "Flexible Saddle") and web only is only reaches the saddle bearing angle.

Fourth, this program can not be used if the distance from saddle to vessel
tangent is greater than half the vessel radius. Additionally, the User's Guide definition for "Distance from the saddle to vessel tangent"on page 9-4 should be read "This distance must be positive and less than 1/2 of the
vessel radius." or "This distance must be positive and less than 0.2 of the vessel tangent to tangent length" instead of "This distance must be positive and less than 1/2 of the vessel tangent to tangent length".

Should you do not agree with my approach to horizontal saddle program please respond with a brief description. Quick response is appreciated.

Yours faithfully.

Ibrahim Demir
Design Engineer

CLIENT ID : 19448
ESL ID: 1741660886