From: Hartman, Daniel J <Daniel.Hartman@mottmac.com>
Sent: Tuesday, June 20, 2017 4:46 PM
To: John St.Hilaire
Cc: Wojnas, Joseph E; Wolf, Brian D; Kibbe, Kelsey E; Guthrie, Karen M
Subject: RE: Vermont Gas Systems - GPTC Calculations

The calculation was run using assuming a fully saturated clay. It would have an effect on the hoop stress from the applied load.

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From: John St.Hilaire [mailto:jsthilaire@vermontgas.com]
Sent: Tuesday, June 20, 2017 4:41 PM
To: Hartman, Daniel J <Daniel.Hartman@mottmac.com>
Cc: Wojnas, Joseph E <Joseph.Wojnas@mottmac.com>; Wolf, Brian D <Brian.Wolf@mottmac.com>; Kibbe, Kelsey E <Kelsey.Kibbe@mottmac.com>; Guthrie, Karen M <Karen.Guthrie@mottmac.com>
Subject: Re: Vermont Gas Systems - GPTC Calculations

Sorry one las qu strong. We found some documentation that the soil type is "LK" meaning Livingston clay - flooded. Which category of the original analysis does LK fit into?

Sent from my iPad

On Jun 20, 2017, at 9:11 AM, Hartman, Daniel J <Daniel.Hartman@mottmac.com> wrote:

> Hey John,
>
> The previous calculations we ran were using the 2' depth of cover and produced effective stresses less than allowable.
>
> I just ran a scenario where we would have 1' of cover with the 25 kip load (the calculation will not allow a trench depth/width ratio less than .5 so I changed the trench width from 3' to 2' now that the cover is down to 1'). The results produced a hoop stress of 71,752 psi from external loading alone and a total hoop stress of 101,175 psi which exceeds the allowable by a large margin without even adding in the S2 and S3 principal stresses. Long story short the calculations pass for up to a depth of 2' but that is the cutoff. I reduced the load from 25kips down to 10 kips and it still fails at the 1' of cover.
>
> Hopefully this answers your question. Feel free to reach back out should you need any further clarification or evaluation.
>
> Kind Regards,
>
> -Danny
>
> **Daniel J. Hartman PE** | Project Engineer

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From: John St.Hilaire [mailto:jsthilaire@vermontgas.com]
Sent: Monday, June 19, 2017 7:14 AM
To: Hartman, Daniel J <Daniel.Hartman@mottmac.com>; Wojnas, Joseph E <Joseph.Wojnas@mottmac.com>
Cc: Wolf, Brian D <Brian.Wolf@mottmac.com>; Kibbe, Kelsey E <Kelsey.Kibbe@mottmac.com>; Guthrie, Karen M <Karen.Guthrie@mottmac.com>
Subject: RE: Vermont Gas Systems - GPTC Calculations

Hi Daniel

Quick follow –up. I am being asked if we are good at 5', 4', 3', and now 2', what is the level where this calculation would show we exceed the total stress? At what depth would the calc exceed 58,500?

Is this something easy to do?

Thanks,
John

From: Hartman, Daniel J [mailto:Daniel.Hartman@mottmac.com]
Sent: Wednesday, May 10, 2017 4:54 PM
To: John St.Hilaire; Wojnas, Joseph E
Cc: Wolf, Brian D; Kibbe, Kelsey E; Guthrie, Karen M
Subject: RE: Vermont Gas Systems - GPTC Calculations

Hey John,

Please see below for the calculation of the total effective stress that results from the wheel load applied using the GPTC method. Feel free to reach out with any questions.

From the GPTC calc we get the combined total stress for the principal plane S1 (hoop stress from internal pressure + hoop stress from applied load)

S1 = 29,423 + 20,206 = 49,629 psi

S1 = 49,629 psi

From the below calculation we get the longitudinal stress which represents the principal stress S2

Design Temperature – T_d =	60	^{o}F
Installation Temperature – T_i =	80	^{o}F
Poisson's Ratio – v =	0.30	
Thermal Coefficient of Steel – α =	6.7×10^{-6}	1 / ^{o}F

Young's Modulus – E = 29×10^6 psi

SL=(vSH-Eα(Td-Ti)) from ASME B31.8 Clause 833.3
*SL=(.3*49,629 -29*10^6*6.7*10^-6(60-80))*
SL= 18,774.7 psi

S2 = 18,774.7 psi

The maximum radial stress results from the negative of the MAOP and represents the principal stress S3

S3 = -1440

The simplified Von Mises equation for principal stresses is used to translate the three principal stresses into the equivalent tensile stress (total effective stress). *Design factor F from ASME B31.8 Clause 833.4b*

Seff=12[S1-S22+S2-S32+S3-S12]

Seff=12[49,629 -18,774.7 2+18,774.7 --14402+-1440-49,629 2]

Seff=44,545.85

Seff≤SMYS×F

44,545.85≤65,000×(.9)

44,545.85≤58,500 OK

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From: John St.Hilaire [mailto:jsthilaire@vermontgas.com]
Sent: Wednesday, May 10, 2017 8:12 AM
To: Wojnas, Joseph E <Joseph.Wojnas@mottmac.com>
Cc: Wolf, Brian D <Brian.Wolf@mottmac.com>; Hartman, Daniel J <Daniel.Hartman@mottmac.com>; Kibbe, Kelsey E <Kelsey.Kibbe@mottmac.com>; Guthrie, Karen M <Karen.Guthrie@mottmac.com>
Subject: RE: Vermont Gas Systems - GPTC Calculations

Hi Joe

Quick question. In the original analysis the result table pulled in "total effective stress". In the additional analysis I do not find this number. How would I correlate the two analysis?

Thanks,
John

From: Wojnas, Joseph E [mailto:Joseph.Wojnas@mottmac.com]
Sent: Monday, May 01, 2017 11:56 AM
To: John St.Hilaire
Cc: Wolf, Brian D; Hartman, Daniel J; Kibbe, Kelsey E; Guthrie, Karen M
Subject: FW: Vermont Gas Systems - GPTC Calculations

John,

Please see the summary below. Kelsey performed the work under the direction of one of our professional engineers. In summary, the pipe looks good.

In talking with the staff the total effort appears to take less than 4 hours. Timesheets are developed at the end of the week where the exact time is collected. With your permission I was going to honor the rates from the Addison Natural Gas Project contract dated January 9, 2015.

Please do not hesitate to contact us with any other questions and/or comments you may have.

Thank you

Joe

From: Kibbe, Kelsey E
Sent: Monday, May 1, 2017 9:48 AM
To: Wojnas, Joseph E <Joseph.Wojnas@mottmac.com>
Cc: Hartman, Daniel J <Daniel.Hartman@mottmac.com>
Subject: Vermont Gas Systems - GPTC Calculations

Hi Joe –

As requested, I've attached two calculations using 2' depth of cover and the weakest soil type. One calculation was run using 1440 psig internal pressure, the other was run using no internal pressure. **Both scenarios pass, the total calculated combined stress for each is less than 90% SMYS.**

Note: the calculations were performed using the GPTC Guide, as 2' depth of cover is out of scope for the API 1102 (method used for previous calculations). A more conservative design wheel load of 25 kips was used.

Let me know if you need anything further.

Thanks,

Kelsey E. Kibbe
Engineer II, EIT

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<image020.png>

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