Asme b31.8 pdf software crack

Upon further analysis, plain dents of any depth are acceptable and are not considered injurious provided strain levels associated with the deformation do not exceed the following strain limits: Half of the minimum elongation specified for a tensile strap test in accordance with the pipe product manufacturing specification or pipe purchase specification 40% of the average elongation from pipe manufacturer mill test reports Where the pipe mill test reports are unavailable and the specification of the pipe is not known with certainty, a maximum strain level of 6% Strain levels may be calculated in accordance with non-mandatory Appendix R or other engineering methodology. equivalent strain It is observed from Figure 3 that 0.2% of the plain dents when assessed using the 2016 equation and 4% when using the 2018 equation exceed the respective strain-based limit, even when the dent depth is acceptable according to the CSA screening criteria, 6% OD. However, the methodology given in Appendix R continues to be the only codified methodology for the calculation of curvature strain. The ASME B31.8-16 equations: Compared to the updated ASME B31.8-18 equations: Where in both versions of the equation: The positive and negative values for $\varepsilon 1$ and $\varepsilon 2$ must be carried through to determine the combined strain on the internal and external pipe surfaces. They also explore the impact this may have on the Canadian Standards Association (CSA) screening criteria used by Canadian operators. ASME B31.8 was revised in late 2018. The median change between 2016 and 2018 was approximately 1.8 times. equivalent strain No strong correlation between D/t and equivalent strain was observed. In this context, Krystin Cousart and Chris Holliday from ROSEN Canada analyze how the recent changes to ASME B31.8, specifically the revision of the equations for dent strain assessment, result in an increase in strain results. The test data indicates that the smallest plain dent to cause a reduction in the failure pressure of a pipe was 20% Outer Diameter (OD) [3]. The reduction of a pipe's failure pressure is affected to a greater extent by the presence of cracking on a dent. equivalent strain (ASME 2018 equation) Figure 5 shows that three plain dents with an L/d greater than 20 are associated with an equivalent strain greater than 6%. References [1] ASME B31.8-2018, Gas Transmission and Distribution Piping Systems, ASME Code for Pressure Piping, B31, The American Society of Mechanical Engineers, 2018. Both of these limits originate from the ASME B31.8 standard. Cracking can initiate due to fatigue cycling or as a result of the dent formation process, i.e. the pipe material exceeds its strain tolerance and cracking occurs. Using the corrected assumptions derives the equation for equivalent ε with the additional constant of and a sign change in the central term, as seen above. A few studies have been conducted [5,6], with scopes that included a review of the equations used to estimate dent strain at their respective times (i.e. ASME B31.8-2003 and ASME B31.8-2016) and suggested revisions to ASME B31.8. It was concluded that the combined strain equation used in ASME B31.8-2016, and prior, considers incorrect plain strain assumptions; therefore, their use can lead to inaccurate results. A more appropriate expression for the equivalent strain was obtained by considering the hypothesis that the strains at the dent region are mainly in the plastic range, where the incompressibility condition may be applied. This study explores the impact of this change and the conservatism within the available screening criteria, such as the depth-based and sharpness clauses given in Section 10 of CSA Z662-19. [4] M.J. Rosenfeld, J. This suggests that the depth-based screening limits are not always conservative. Clause 10.10.10.4.2.c) addresses this aspect. However, this sample is too small to derive any real conclusions. A sample of 1,485 dents (0.5% OD to 11.3% OD) were investigated from a variety of pipelines operated in Canada and the United States of America. This suggests that, when assessed with the ASME B31.8 2016 equation, screening using an L/d criterion of 20 is generally suitable and conservative. The 1,485 dents were assessed using both the 2016 and the 2018 ASME B31.8 Appendix R equations. The pipelines ranged from 6 inches to 48 inches in nominal pipe size and featured wall thicknesses from 3.18 mm to 12.70 mm. This is, in principle, a factor of safety of 2 on the strain at which fracture may be more likely, i.e. 12%. When reviewing all 1,485 dents, it can be observed that in a number of cases, dents with acceptable depths, i.e. less than 6% OD (or less than 2% if associated with a weld), are associated with an equivalent strain that exceeds the respective 6% or 4% strain limit. ASME B31.8 provides a method for calculating curvature strain in non-mandatory Appendix R, but it also provides an allowance for other engineering methodologies. The above data suggests that an L/d screening criterion of 20 may be non-conservative in some cases for screening purposes and that the industry should review a larger data set to identify a more appropriate screening limit. However, it is likely that these are sharper dents and may be "caught" by the L/d criteria. Therefore, international standards agencies, such as the American Society of Mechanical Engineers (ASME), issue relevant standards that regulate the design, operation, maintenance and integrity management of pipelines. The data sample reviewed as part of this study suggests that an L/d screening limit of 40 may be more appropriate when strain is determined using the ASME B31.8-2018 equation. However, based on the ASME B31.8-2018 strain equations, an L/d screening criterion of 20 is potentially non-conservative in some cases, suggesting a different criterion may be required for screening purposes. Furthermore, it is noted that nine dents associated with a weld have an associated strain greater than 4%, with an L/d greater than 20. These limits have been elaborated in the 2018 version of ASME B31.8. ASME now states that: d) Plain dents are defined as injurious if they exceed a depth of 6% of the nominal pipe diameter. [2] CSA Z662:19, National Standard of Canada, Oil and gas pipeline systems, June 2019. [5] Noronha et al., Procedures for the strain-based assessment of pipeline dents, International Journal of Pressure Vessels and Piping, March 2010. If the L/d or depth-based criteria are exceeded, then both CSA Z662 and ASME B31.8 allow for a curvature strain assessment to be performed to demonstrate the acceptability – or otherwise, – of a dent. The widely accepted depth-based criteria screen for failure pressure, i.e. failure under static loading. Figure 4 – L/d vs. It can also be observed from Figure 4 and Figure 5 that the absolute difference in calculated strain using the 2016 or 2018 equation is greater for sharper dents. However, the three plain dents with an L/d greater than 20 and strain greater than 6% range in depth from 1.6% OD to 2.4% OD and therefore would not have been "captured" by the depth-based criteria and may have remained unrepaired in the pipeline. IPC2002-27122 [4] describes the task group's selection of an appropriate strain-based limit for dents. A static curvature strain-based assessment can be used to determine the likelihood for a crack to have initiated during dent formation. [6] S.A Lukasiewicz, J.A Czyz, C. Figure 7 Diameter to wall thickness ratio vs. W. Based on the superseded ASME B31.8-2016 strain equations, an L/d screening criterion of 20 is generally suitable and conservative. On average (mean), a 1.7-times change between the results of the two strain equations was observed. Figure 6 – Diameter to wall thickness ratio vs. That is because safely transporting energy products through pipelines is the key to the success of the oil and gas industry. equivalent strain Figure 2 – 2018 vs. [3] A. In addition, it can be seen that overall, as the L/d decreases (i.e. dents become sharper), the absolute difference in strain results between 2016 and 2018 increases. To elaborate, only a limited number of dents with L/d between 20 and 40 were assessed, so it is feasible that if a larger sample of dents with an L/d between 20 and 50 were to be reviewed, then a need for a more conservative limit may be considered. The task group settled on a 6% limit in the pipe body as a threshold. Empirical results showed that the likelihood of puncture and cracking appear to increase where material strain exceeds about 12%. dent depth Figure 6 shows that the pipelines with a ratio of diameter to wall thickness of 30 to 70 had the deepest dents reported compared to other ratios of diameter to wall thickness. As strain is accepted as the more accurate screening approach for a dent's susceptibility to cracking during formation, an opportunity arises to compare calculated strain to the 1) depth-based and 2) sharpness-screening criteria given in CSA Z662 and to provide comments. A number of changes were made to the equations given in this appendix between the 2016 and 2018 versions of ASME B31.8. The equations are compared below, with eliminations marked in red and additions in green. However, it is noted that one dent on a weld has an associated strain greater than 4% with an L/d greater than 20. 2018 strain results) and length to depth ratio (L/d). Pepper, K.L. Leewis, Basis of the New Criteria in ASME B31.8 for Prioritization and Repair of Mechanical Damage, IPC2002-27122, Proceedings of IPC 2002, 4th International Pipeline Conference, Calgary, Alberta, Canada, September 29 – October 3, 2002. Cosham, P. These standards are routinely revised and amended in line with the latest industry research and guidance. The limit is given as 6% and 4%, respectively. There are standards for almost everything – machines, cars, technical and medical equipment – and, of course, there are standards for pipelines. November 2018, the American Society of Mechanical Engineers (ASME) revised the equations given in the non-mandatory Appendix R, which is used to calculate equivalent strain on the internal and external pipe surfaces [1]. The industry-accepted equations for calculating curvature strain are dependent on the dent radius of curvature. When measured at pressure, a limit of 7% OD was proposed for plain, unrestrained dents and adopted by standards such as API 579. They play a key role in keeping us safe. In a Nutshell: Why do we need standards? Earlier versions of ASME B31.8 permitted field bends that impart a cold strain in the pipe wall up to 3%. It is highlighted that eight of the nine dents associated with welds with an L/d greater than 20, and strain greater than 4%, range in depth from 2% OD to 5% OD and therefore would have been "captured" by the depth-based screening criteria for strain assessment. 2016 equivalent strain From Figure 2, it can be seen that the maximum difference between the 2018 strain results is roughly two times that of the 2016 strain results, whereas, in some instances for very low strain values, the 2018 and 2016 results are virtually equivalent. Sun, S. The CSA L/d criteria can be rapidly applied to a large number of deformations based on reported dimensions and are a useful screening criterion for the "sharpness" of a dent. Both ASME B31.8 and CSA Z662 adopted a marginally more conservative depth limit of 6% OD. equivalent strain (ASME 2016 equation) Figure 4 shows that no plain dents with an L/d greater than 20 are associated with an equivalent strain greater than 6%. It is thus feasible that if a larger sample of dents with an L/d between 20 and 50 were to be assessed, then an even more conservative limit should be considered. Section 10.10.4.2 of CSA Z662-19 [2] provides the wider industry with a number of screening criteria for the identification of deformations that require further investigation, assessment or remediation. Adeeb, Calculation of strain in dents based on high-resolution in-line caliper survey, Proceedings of the sixth international pipeline conference, ASME, paper IPC2006-10101, Calgary, Alberta, Canada, 2006. A postulation that can be drawn for shallower dents in higher outside diameter to wall thickness (D/t) ratio pipe is that there is a greater propensity for rerounding after indentation. The study also compared the equation used in ASME B31.8-2016 and the revised equation, now in ASME B31.8-2018. Figure 3 – Dent depth (% OD) vs. The smaller the radius of curvature, i.e. if the dent is sharper, the higher the associated strain. Other published methodologies for calculating curvature strain are available; however, this investigation has only considered the 2016 and 2018 forms of the equations given in ASME B31.8 Appendix R. This suggests that, when assessed with the ASME B31.8 2018 equation, an L/d screening criterion of 20 can be non-conservative in some cases. Figure 5 suggests that an L/d screening limit of 40 may be more appropriate when strain is determined using the ASME B31.8-2018 equation. This is presented in Figure 1. Figure 5 – L/d vs. However, the majority of the samples were selected for assessment because their L/d was less than 20. CSA Z662-19 provides a curvature strain limit for both plain dents and dents associated with a weld. Hopkins, The Pipeline Defect Assessment Manual (PDAM), A report to the PDAM joint industry project, Penspen Limited, June 2006. A limit of 10% OD was proposed for unrestrained plain dents measured at zero pressure or restrained dents measured at pressure (this, in essence, is a factor of safety of 2 and provides an allowance for the passage of in-line inspection tools). Figure 1 – L/d vs. It was found that the combined strain equation in ASME B31.8-2016 provided non-conservative results in comparison to the revised equation in ASME B31.8. These equations are further compared in the following section. The authors acknowledge that the majority of the sampled dents were selected for assessment because their L/d was less than 20. They are empirical models based on a range of full-scale test data. A review was conducted, and there is no clear relationship between percent difference (2016 vs. After comparing the strain results, it is evident that the 2018 equations provide higher strains consistent with the findings of the previous studies. It is recommended that the industry review a larger data set to identify a more appropriate screening limit. It is observed that 6% of the dents associated with welds when assessed using the 2016 equation and 17% when using the 2018 equation exceed the respective strain-based limit of 4%, even when the dent depth is acceptable according to the CSA screening criteria, 6 mm or 2% OD. Three of the criteria are dependent on reported dent dimensions and are reproduced verbatim here: The following dents are considered as defects unless determined by an engineering assessment to be acceptable: a) Dents that interact with a mill or field weld and exceed(s) A depth of 6 mm in pipe 323.9 mm Outside Diameter (OD) or smaller, unless their measured curvature strain is less than 4% and the interacting portion of the weld passes nondestructive inspection criteria; or 2% of the outside diameter in pipe larger than 323.9 mm OD, unless their measured curvature strain is less than 4% and the interacting portion of the weld passes nondestructive inspection criteria; b) Dents that are located on the pipe body and exceed a depth of 6 mm in pipe 101.6 mm OD or smaller or 6% of the outside diameter in pipe larger than 101.6 mm OD, unless their measured curvature strain is less than 6%; c) Dents with a length to depth ratio (L/d) less than 20, unless their measured curvature strain is less than 6% A depth-based screening is straightforward to apply to a large number of reported dents, but it does not account for the sharpness of a given dent.

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