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## **Abstract**

Stresses along the length of pipelines, termed longitudinal stresses, are generated by pipeline construction, service conditions, and changes in pipe support conditions. Although there are no explicit federal regulations limiting longitudinal stresses for in-service pipelines, pipeline operators typically rely on design requirements in established standards, such as ASME B31.4, B31.8, and CSA Z662, to manage possible integrity concerns arising from longitudinal stresses.

In this paper longitudinal stress limits in existing standards are reviewed. These standards include CSA Z662, ASME B31.4, ASME B31.8, DNV RP F101 and API RP 1111. These standards provide various formulae or specific values for the longitudinal stress limits. These limits are compared under various levels of internal pressure. Although the potential failure modes addressed by the different standards may be similar, the specific limits on longitudinal stresses differ among the standards. One of the interesting findings is that the limit on compressive longitudinal stress can be very low when the combined stress criteria (von Mises or Tresca) are applied to pipelines operating at a pressure level equivalent to Class 1 design of gas pipelines, i.e., hoop stress being 72% SMYS. The resulting compressive stress limits, at 18-29% SMYS by some standards, are much lower than often quoted 90%, 80%, or 54% SMYS limits. These quoted limits refer to limits for tensile stresses, but sometimes mistaken for compressive stress limits. The low compressive stress limits can be quite difficult to manage for spans after the addition of possible compressive stresses from temperature differential, lateral bending, and other sources.

Alternative stress limits that provide a consistent level of safety and in compliance with the spirits of standards are proposed. The new limits are sound from the viewpoint of safety, yet practical to apply. One possibility of increasing the compressive stress limit is reducing the hoop tensile stress by lowering operating pressure. The other possibility is setting a combined equivalent stress limit that is not overly conservative and preserves a sound level of safety. An example is provided to illustrate the assessment of a span against the stress limits.

## **Keywords**

Pipeline integrity, Longitudinal stress limits, Spans, Girth weld integrity